SHORT PAPER

The evil eye: Eye gaze and competitiveness in social decision making

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Abstract

We demonstrate that a person's eye gaze and his/her competitiveness are closely intertwined in social decision making. In an exploratory examination of this relationship, Study 1 uses field data from a high-stakes TV game show to demonstrate that the frequency by which contestants gaze at their opponent's eyes predicts their defection in a variant on the prisoner's dilemma. Studies 2 and 3 use experiments to examine the underlying causality and demonstrate that the relationship between gazing and competitive behavior is bi-directional. In Study 2, fixation on the eyes, compared to the face, increases competitive behavior toward the target in an ultimatum game. In Study 3, we manipulate the framing of a negotiation (cooperative vs. competitive) and use an eye tracker to measure fixation number and time spent fixating on the counterpart's eyes. We find that a competitive negotiation elicits more gazing, which in turn leads to more competitive behavior.

"Brent never trusted anyone who couldn't look him in the eye. It was a sign of dishonesty" (Eade, 2013). This quote from a spy novel captures the long-standing folk belief that looking into the eyes of another human is a physical marker of benevolence (Bayliss & Tipper, 2006; Hemsley & Doob, 1978). However, a number of studies paint a very different picture of the motivations behind such 'eye gazing' or 'eye fixation' – one of dominance and aggression rather than honesty and benevolence.[1] In this investigation, we use archival and experimental methodologies to examine the relationship between eye gaze and competitive behavior. We focus on the behavior of the individual who gazes and find that the relationship between gazing and behavior is bi-directional: fixating on one's counterpart's eyes increases one's own competitiveness, and a competitive mindset increases fixation on one's counterpart's eyes.

Eye Gaze and Competitive Behavior

Competitive situations are characterized by both people's orientation toward maximizing their own outcomes and comparing them to that of the other (Schelling, 1980; Van Lange, 1999). Research has shown that a wide array of factors might affect competitive behavior, such as the perceived intentions of the other (Ten Velden, Beersma, & De Dreu, 2011), group membership (Insko, Wildschut, & Cohen, 2013), and hormones such as testosterone (Bernhardt, 1997; Burnham, 2007).

Abundant research also suggests that competition and dominance are associated with gazing behavior. Within non-human animals, for example, direct gaze is associated with dominance, threat, and competition (Emery, 2000). Dogs are more likely to show obedience when human eyes are upon them (Call, Bräuer, Kaminski, & Tomasello, 2003) and chickens tend to become rigid with fear when being gazed upon (Gallup, Cummings, & Nash, 1972). Similarly, non-human primates exhibit more submissive behavior, such as lip-smacking and teeth chattering, when watched by conspecifics (Emery, 2000; Öhman, 1986). Neuroscientific research has revealed that human and non-human primates share a similar neural architecture for recognizing and reacting to eyes (Baron-Cohen, 1995; Emery, 2000). This suggests that such responses are ingrained by evolution and inherited from humans' primate ancestors (Burnham & Hare, 2007; Milinski & Rockenbach, 2007).

Among humans, a direct gaze is perceived as more threatening than an averted gaze (Sato, Yoshikawa, Kochiyama, & Matsumura, 2004) and seen as a sign of dominance (Ellsworth, 1975; Hillabrant, 1974). Furthermore, gazing eyes activate neural circuitry related

[1]We use the terms *eye gaze* and *eye fixation* interchangeably. We also use the term *direct gaze*, which refers to being looked into the eye by someone else, and mostly avoid the term *eye contact*, because it is commonly used for mutual eye gazing, which is a construct beyond the scope of this investigation.

to fear (Schneier, Kent, Star, & Hirsch, 2009) and trigger negative emotions (Sato et al., 2004). Some studies suggest that a direct gaze generates compliant and submissive behavior in the target (Baillon, Selim, & Van Dolder, 2013; Bateson, Nettle, & Roberts, 2006; Ernest-Jones, Nettle, & Bateson, 2011; Nettle et al., 2013). Taken together, this research suggests that gazing plays a central role in social interactions through its association with competition, which is not surprising considering that, in general, gazing can be conceived as a powerful tool to regulate social interactions (Wu, Bischof, & Kingstone, 2014).[2]

The association between gazing and competition has also been examined in the context of social decision making. Carnevale, Pruitt, and Seilheimer (1981) provided a first indication of such association. They hypothesized and found that because negotiations are often construed as competitive settings in which threats can be communicated non-verbally, preventing visual access to the counterpart promoted cooperation and high-quality agreements; *less* visual contact decreased competitive behavior. Although their study convincingly showed that visual contact affects behavior toward others in a social setting, it did not indicate whether eye gaze in and of itself was responsible for the increased competition when visual contact was permitted.

Given the ingrained association between gazing and competition, which might be partly biological or the result of repeated experience, we hypothesize that eye gazing triggers a more competitive mindset, and that a competitive mindset induces more eye gazing than a cooperative mindset. The literature offers some support for each of these two directions of causality. Jarick and Kingstone (2015) found that people were more comfortable sustaining prolonged eye-contact after a competitive (vs. cooperative) interaction. And Chen, Minson, Schöne, and Heinrichs (2013) found that gazing at the eyes (instead of the mouth) of a speaker lowers one's willingness to accept his or her arguments.

The purpose of the present research is to investigate whether there indeed exists a bi-directional link between a person's eye gaze and his or her competitiveness. As an exploratory step, Study 1 examines the correlation between eye gaze and competitive behavior in a high-stakes field setting. As hypothesized, eye gaze predicts competitive behavior. Studies 2 and 3 use experiments to examine the underlying causality and show that the relationship between gazing and competitive behavior is bi-directional. In Study 2 we manipulate eye gaze and find that gazing at the eyes of the counterpart increases the gazer's competitive behavior in an ultimatum game. In Study 3 we frame a negotiation as either competitive or cooperative, and, using an eye-tracker, we find that people gaze more at their counterpart's eyes in the competitive condition. Study 3 also corroborates the finding of Study 2 that more gazing leads to more competitive behavior.

Study 1

Study 1 examines whether frequency and duration of eye gaze predict the behavior of game show contestants in a variant on the prisoner's dilemma. Contestants' decisions were consequential: the stakes averaged £14,298 and ranged up to £100,150.

Methods

Game show description. The TV game show *Golden Balls* aired in the United Kingdom from June 2007 until December 2009.[3] Each episode comprised several phases with the last one being the focus of the present research. In this phase, two contestants had to decide how to distribute the jackpot accumulated during the previous phases. Each contestant could either "split" or "steal". If both chose "split", they shared the jackpot equally. If one chose "split" and the other chose "steal", the contestant who stole took the whole jackpot and the other got nothing. If they both chose "steal", they both got nothing. Before each contestant made his or her actual decision, a brief time period was reserved for a discussion between the players in which they could make promises, ask about intentions, or attempt to get assurances. The players had not met before the game started and there was no opportunity before or during the show to make a binding agreement.

Participants. We analyzed the gazing behaviors and final decisions of both players in the first two seasons (100 episodes) of the show. One episode was not included in our analyses because we were unable to play the DVD of that particular episode. The total sample thus consisted of 198 participants (54.0% female, M_{age} = 35.34 years, SD_{age} = 10.72).

Dependent variable. The main dependent variable of the study was the decision to either "split" or "steal", with "steal" being operationalized as the option that signified competitive (rather than cooperative) behavior.

Independent variables. Two trained, independent coders coded the gazing behavior during participants' discussion prior to the split/steal decision. They started coding from the time the host, Jasper Carrott, allowed the participants to start talking to one another about the decision until the time he told them to make their decisions. The coders independently recorded the

[2]Another line of research examines how people gaze at and remember those who act in antisocial ways (e.g., Chiappe, Brown, & Dow, 2004; Mealey, Daood, & Krage, 1996; Vanneste, Verplaetse, Van Hiel, & Braeckman, 2007; Yamagishi, Tanida, Mashima, Shimoma, & Kanazawa, 2003). As this is beyond the scope of the current investigation, we do not discuss this literature in further detail.

[3]The DVD's with the Golden Balls videos used in Study 1 will be stored at a secure location for at least 10 years by the fourth author, Martijn van den Assem. The raw data used in Studies 2 and 3 will be archived on a University of Rome Sapienza server for at least 10 years by the first author, Mauro Giacomantonio.

number of seconds each participant was visible on screen, and for each contestant they estimated both the frequency and duration of eye gaze. If the frequency count differed by more than two or the eye-gaze time differed by more than two seconds, the coders were asked to go back and recode that episode. Final intra-class correlation between raters was >.98 for both variables, indicating very high inter-rater reliability. We used the average of the two coders' estimates as the focal independent variables. Since we were only able to observe participants' behavior when they were visible on screen, we then divided the number and duration of eye gaze by the time a participant was visible.

Control variables. Demographic characteristics and game situations varied across episodes and we used these as control variables. The demographic variables captured information on age, gender, race, place of residence, and education. The game situation variables described the size of the jackpot, how many times the show had been aired prior to recording, and whether the opponent had tried to vote the participant off the show at an earlier stage. All these variables were previously defined and used in Van den Assem, Van Dolder, and Thaler (2012), p. 13, Model 6.

Table 1 Descriptive statistics (Study 1)

	Mean	SD
Eye fixation – time (proportion)	.67	.19
Eye fixation – number (per second)	.50	.15
Age (years)	35.34	10.72
Gender (male = 1)	.46	.50
Race (white = 1)	.93	.26
City (250 000 or more inhabitants = 1)	.52	.50
London (London = 1)	.17	.38
Education (BSc or higher = 1)	.33	.47
Student (student = 1)	.07	.25
Actual stakes (log)	8.18	2.18
Potential stakes (log)	10.63	.58
Transmissions	24.24	19.59
Vote received from opp (yes = 1)	.06	.23

Note: $N = 198$. All monetary values are in UK Pounds (£1.00 ≈ $1.75 at the time of recording). *Actual stakes* is the natural logarithm of the size of the jackpot. *Potential stakes* is the natural logarithm of the highest possible jackpot in the round prior to the final. *Transmissions* expresses the number of episodes that were already aired when the current episode was recorded in the studio. *Vote received from opp* is a dummy variable taking the value of 1 if the contestant's opponent has tried to vote him/her off the program at an earlier stage of the game.

Analyses. We conducted two binary logistic regressions. In the first, we entered eye-gaze number and duration as the only predictors. In the second, we also included the control variables and the counterpart's eye-gaze variables. All analyses were conducted using standardized variables. Standard errors were corrected for clustering at the level of the episode to account for non-independence of observations (Wooldridge, 2003).

Results

Table 1 reports the descriptive statistics of the explanatory variables and Table 2 reports the regression results. Eye-gaze number predicted the likelihood that the contestant chose "steal" (rather than "split"), $\beta = -.41$, $OR = .66$, $p = .005$. The duration had no significant effect, $\beta = .07$, $OR = 1.07$, $p = .63$. The results did not change materially when we included the variables for the opponent's eye gazing and the control variables.

Interestingly, the decision to "split" or "steal" was predicted by one's own eye gazing but not by the opponent's eye gazing. Indeed, both opponent's eye-gaze number, $\beta = .12$, $OR = 1.13$, $p = .39$, and opponent's eye-gaze duration, $\beta = .26$, $OR = 1.30$, $p = .14$, did not predict the participants' final decision.

Discussion

Study 1 provided support for the assertion that a person's eye gaze is associated with their competitive behavior. Cooperation in a variant on the prisoner's dilemma was predicted by the number of times the contestant looked at their counterpart's eyes, but not by the duration.

Table 2 Results of binary logistic regression on participants' decision to split or steal (Study 1)

	Model 1				Model 2			
	β	*OR*	*z*	*p*	β	*OR*	*z*	*p*
Fixation number	−.41	.66	−2.81	.005	−.44	.64	−2.51	.012
Fixation duration	.07	1.07	.49	.627	.11	1.12	.70	.481
Fixation number opponent					.12	1.13	.85	.393
Fixation duration opponent					.26	1.30	1.46	.144
Constant	.12	1.13	.85	.394	.15	1.16	.96	.338
Control variables		No				Yes		
Wald χ^2 (*df*)		8.06 (2)				35.65 (17)		
Log pseudo-likelihood		−133.08				−119.88		
Pseudo R^2		.03				.12		
Number of clusters		198				198		
Number of observations		99				99		

Note: Decision to steal or split was dummy coded with 0 = *steal* and 1 = *split*.

This study used a real-life, high-stakes decision situation, providing a meaningful level of psychological realism (Wilson, Aronson, & Carlsmith, 2010). A possible downside of the material is that it may better reflect what the producers of the show wanted the audience to see (or think), rather than what was actually taking place. This point considered, it seems implausible that producers would deliberately show more gazing when the person steals than when the person splits. To further examine the relationship and establish the directionality, we conducted Studies 2 and 3, where we experimentally manipulated and then measured the variables of interest. In Study 2, we investigated whether gazing at the eyes affects subsequent competitive behavior. In Study 3, we investigated the opposite direction of causality.

Study 2

Methods

Participants and design. Seventy-five students (57.3% female, M_{age} = 23.39 years, SD_{age} = 2.04) were recruited and randomly assigned to one of two experimental conditions (Eyes vs. Face) in a between-subjects design. Three participants were excluded from the analyses: two failed to make an offer in the ultimatum game and for one it was not possible to retrieve the experimental condition.

Procedure. Participants were welcomed and seated at a cubicle in a larger room. Participants assumed the role of a proposer who would make an offer to another participant about how to distribute €100 between them in an ultimatum game (Güth, Schmittberger, & Schwarze, 1982; Oosterbeek, Sloof, & Van De Kuilen, 2004). They learned that they could propose any distribution, that their counterpart could either accept or reject their offer, and that a rejected offer would lead to an outcome of €0 for both. In reality, there was no actual counterpart and no real monetary consequence.

Before proposing their offer, participants were given a photo of their alleged counterpart in the upcoming interaction. This picture was chosen from the Karolinska Directed Emotional Faces database (Lundqvist, Flykt, & Öhman, 1998) so to be as emotionally neutral as possible and compatible with the typical look of local students. Participants watched the picture for 1 minute with the instruction of memorizing specific details.

In the Eyes condition, participants were explicitly asked to focus on the eyes of the other person, memorizing shape, color, and all pertinent details such as eyelashes and eyebrows. In the Face condition, participants were asked to memorize the face, including ears, chin, hair, and head shape (see Chen et al., 2013, for a similar manipulation). See Figure 1 for the exact image.

Participants then proposed the division of the money. Four participants offered their counterpart more than half the endowment (i.e., more than €50). As it is rare for people to make offers greater than 50% (Harrison & McCabe, 1996; Zeelenberg & Beattie, 1997) and because such behavior signals either poor comprehension of the task or an exceptional altruistic motivational orientation (Joreiman, Lasane, Bennett, Richards, & Solaimani, 2001; Liebrand & McClintock, 1988; Murphy, Ackermann, & Handgraaf, 2011), we excluded these observations from the main analyses.

Fig. 1: Picture used in Studies 2 and 3, with the focal areas analyzed in Study 3 highlighted (ex post) [Colour figure can be viewed at wileyonlinelibrary.com]

To check the adequacy of the manipulation, we asked each participant what percentage of the assigned time they had spent watching (1) the eyes and (2) the face of the counterpart (1 = *very small*, 7 = *very high*).

Results

Manipulation check. We ran a 2 (Eyes vs. Face) × 2 (Time on eyes vs. face) ANOVA with the last factor as a within-subjects variable. The significant two-way interaction, $F(1, 70) = 11.88$, $p = .001$, $\eta_p^2 = .15$, supported the adequacy of the manipulation. Participants in the Eyes condition reported spending more time on the eyes ($M = 5.53$, $SD = 1.21$) than participants in the Face condition ($M = 4.97$, $SD = 1.44$), $F(1, 70) = 3.14$, $p = .08$, and participants in the Face condition reported spending more time on the face ($M = 5.17$, $SD = 1.38$) than participants in the Eyes condition ($M = 4.00$, $SD = 1.35$), $F(1, 70) = 13.09$, $p = .001$.

Ultimatum offer. Consistent with our predictions, a one-way ANOVA revealed that participants' offers were lower in the Eyes ($M = 40.47$, $SD = 12.85$) than

in the Face condition (M = 45.69, SD = 7.38), $F(1, 66) = 4.35$, $p = .04$, $\eta_p^2 = .06$.[4]

Discussion

By using a negotiation context and manipulating participants' eyes (vs. face) fixation, Study 2 demonstrated that fixating on another's eyes induced greater competitiveness toward this person. This result is consistent with our hypothesis, but provides evidence for only one part of the bi-directional relationship between gazing and behavior. The next study focuses on the reverse direction. A limitation of Study 2 is that the manipulation check relied on self-reported gazing behavior. Previous research using eye-tracking established that instructions like the ones used here have the desired effect on gazing (Chen et al., 2013). Study 3 avoids the reliance on self-reports by directly measuring eye gaze using an eye tracker.

Study 3

After establishing that eye gaze increased competitive behavior, in Study 3, we investigate whether a more competitive motivation leads to more eye gazing. In Study 3, we also again test whether eye gaze affects subsequent behavior.

Methods

Participants and design. Fifty-three students (75% female, M_{age} = 24.42 years, SD_{age} = 4.00) were recruited and randomly assigned to one of two experimental conditions (cooperative vs. competitive) in a between-subjects design. Two participants were excluded from the analyses due to technical problems with the recording of the eye-tracking data.

Procedure. Participants were seated at a desk where they received a booklet containing the negotiation instructions. We told participants that they were about to enter a dyadic negotiation, described as competitive or cooperative in nature (De Dreu, Beersma, Stroebe, & Euwema, 2006). Task instructions were modeled after previous research (see De Dreu, Giacomantonio, Shalvi, & Sligte, 2009) and described a job contract negotiation on five different issues (salary, starting date, raise, insurance, moving expenses). All participants played the role of the recruiter. For each issue, there were five possible agreements, which each provided participants with a certain number of points. For example, participants could settle on an annual raise of 1, 2, 3, 4, or 5%, yielding 40, 30, 20, 10, or 0 points respectively. In the cooperative condition, participants were informed that it is important that both the recruiter and the candidate achieve good joint outcomes. In the competitive condition, participants were informed that it is important to individually achieve as much value as possible. Participants were then given a manipulation check.

After reading the instructions, a picture of the alleged counterpart (see Study 2, Figure 1) was shown on the computer screen for 30 seconds. We recorded eye fixations using an eye tracker (see below). The main dependent variables of the study were (1) the number of fixations on the counterpart's ocular area, (2) the percentage of time spent fixating on the counterpart's ocular area, and (3) the average first offer across the five issues.

Eye tracking. Eye position was recorded using the SMI-RED system, which permits remote, contact-free sampling of the pupil location at 120 Hz. The eye movement registration was restricted to the face presentation and two distinct areas of interest: (1) the eye region, that is, the area immediately encircling the eyes including eyebrows, and (2) the mouth region, that is, the area surrounding the mouth and lips (the chin was not included in this area). We recorded both fixation number (count) and time (percentage). Figure 1 illustrates the two areas of interest.

Manipulation check. We adopted four items used in previous research (e.g., *In the following negotiation I will try to get a fair agreement*, 1 = *not at all*, 5 = *very much*, α = .72; De Dreu et al., 2006) and averaged these to get a mean score of participants' perceptions of the upcoming interaction.

Competitive behavior. Participants were required to write down their opening offer to their opponent on each of the five negotiation issues. To measure participants' competitive behavior, we calculated the average offer across the five issues, where the lowest possible offer was set at the value of 1 and the highest at the value of 5. Lower average offers indicated more competitive behavior.

Results

Manipulation check. As predicted, in the cooperative condition, participants anticipated a more fair and socially harmonious interaction (M = 3.38, SD = .69) than in the competitive condition (M = 2.79, SD = .63), $F(1, 49) = 10.13$, $p = .003$, $\eta_p^2 = .17$.

Competitive behavior. As predicted, participants in the competitive condition offered less to their counterpart (M = 1.39, SD = .59) than did participants in the cooperative condition (M = 1.83, SD = .63), $F(1, 49) = 6.64$, $p = .01$ $\eta_p^2 = .12$.

Eye tracking. We first conducted a 2 (cooperative vs. competitive negotiation) x 2 (eye vs. mouth area) ANOVA on fixation count with the last factor as a within-subjects variable. The analysis yielded a significant main effect, $F(1, 49) = 38.38$, $p < .001$, $\eta_p^2 = .44$;

[4]With all observations included, a one-way ANOVA revealed no significant effect of our manipulation, $F(1, 70) = .83$, $p = .37$, $\eta_p^2 = .01$.

participants fixated more on the eye (M = 35.08, SD = 19.90) than the mouth area (M = 17.47, SD = 10.54). And as hypothesized, we observed a significant interaction between the area of interest and the framing of the upcoming negotiation, $F(1, 49) = 7.85$, $p = .007$, $\eta_p^2 = .14$. As seen in Panel A of Figure 2, fixation on the eye region was greater in the competitive (M = 42.15, SD = 21.93) than in the cooperative condition (M = 27.72, SD = 14.63), $F(1, 49) = 7.59$, $p = .008$, $\eta_p^2 = .13$; fixations on the mouth area did not vary between competitive (M = 16.81, SD = 11.93) and cooperative condition (M = 18.16, SD = 9.07), $F(1, 49) = .21$, $p = .65$, $\eta_p^2 = .004$.

Similarly (Figure 2, Panel B), fixation time showed a significant main effect, $F(1, 49) = 40.07$, $p < .001$, $\eta_p^2 = .45$; participants spent more time on the eye (M = 37.50, SD = 19.04) than the mouth area (M = 19.12, SD = 12.71). As hypothesized, a two-way interaction between area of interest and the framing of the upcoming negotiation emerged, $F(1, 49) = 7.66$, $p = .008$, $\eta_p^2 = .14$. Participants in the competitive condition spent a higher percentage of time looking at the ocular area of their negotiation counterpart (M = 43.41, SD = 21.12) as compared to those in the cooperative condition (M = 31.36, SD = 14.61), $F(1, 49) = 5.57$, $p = .02$, $\eta_p^2 = .10$. Time spent fixating on the mouth did not vary between the competitive (M = 17.22, SD = 13.89) and cooperative condition (M = 21.10, SD = 11.30), $F(1, 49) = 1.19$, $p = .28$, $\eta_p^2 = .02$.

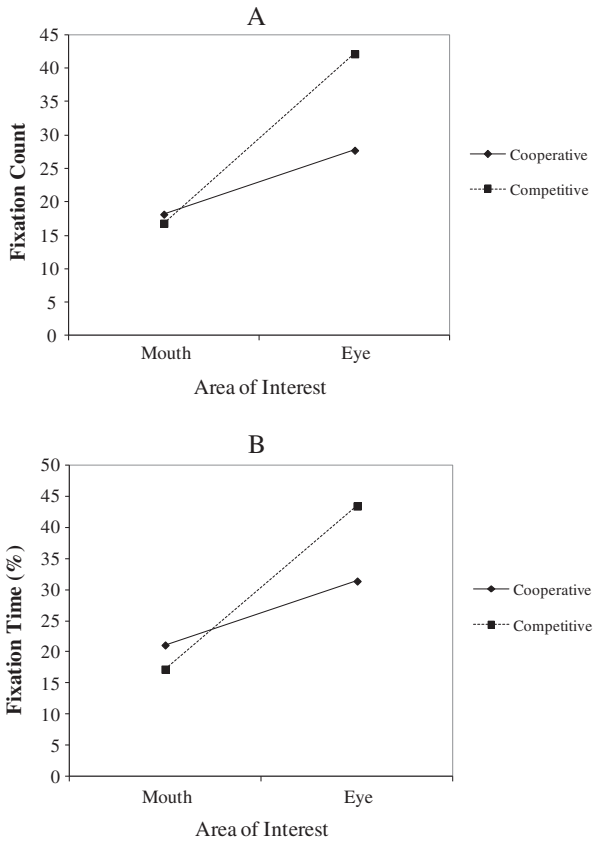

Fig. 2: Eye fixation count (Panel A) and eye fixation time (Panel B) for the two areas of interest as a function of the framing of the upcoming negotiation (Study 3)

Mediation analysis. For the eye region, both fixation count, $r = -.38$, $p = .005$, and time, $r = -.43$, $p = .002$, were negatively correlated with the size of the offer. To examine if fixation on the ocular area explained the impact of social motivation on the size of participants' opening offers, we ran a bootstrap mediation analysis, examining fixation count as the mediator for offer size. Fixation count was responsible for the association between social motivation and offer size (coefficient for the indirect effect = −.14, SE = .10, bias-corrected 95% CI: Lower = −.01; Upper = −.42). Consistently, in a separate analysis we found that fixation percentage mediated the effects of social motivation on offer size (coefficient for the indirect effect = −.14, SE = .09, bias-corrected 95% CI: Lower = −.03; Upper = −.43).

Discussion

Study 3 shows that a competitively framed negotiation increases people's fixation on their negotiation counterparts' ocular area and that this fixating explained their reduced offers. The latter reinforces the result of Study 2 where manipulating participant's eye fixation induced more competitiveness toward the counterpart. These results suggest that competitive motivation affects competitive behavior via increased fixation on another person's eyes.

General Discussion

The present investigation examined the effects of eye gaze from a novel perspective. Rather than examining how fixating on another's eyes affected the target's perceptions and behavior, we examined the relationship between one's own gazing and competitiveness toward the target. In doing so, we contributed to knowledge on interpersonal competition and cooperation by showing that gazing not only serves as a social tool to acquire and signal competitive intentions (the dual function of gaze; Gobel, Kim, & Richardson, 2015; Jarick & Kingstone, 2015) but also instigates competitive behavior on the part of the fixator. The role of bodily states in competitive behavior is often neglected by research on conflict and social decision making.

In Study 1, we ventured outside the laboratory as a first step in studying the relationship between eye gaze and competitiveness. Using episodes from a televised game show, we observed that the estimated frequency by which a contestant looked into the other's eyes predicted his or her defection in a variant on the prisoner's dilemma with high stakes. In Studies 2 and 3, we used experiments to examine the underlying causality. Study 2 demonstrated that instructing participants to focus on their counterpart's eyes decreased offers in the ultimatum game, whereas Study 3 demonstrated that a negotiation framed as competitive triggered more gazing on the eyes than a negotiation framed as cooperative. Study 3 also corroborated the finding from Study 2 that more eye gazing led to more competitive behavior.

Combined, the two experiments provided evidence that the relationship between gazing and competitiveness is bi-directional: fixating on eyes increased competitiveness and competitiveness increased fixation on eyes.

Contrary to Study 3, where both number and length of fixations predicted competitive behavior, Study 1 yielded a significant result for the frequency of eye gaze only. Taken at face value, this discrepancy suggests that in real-life situations, number, rather than duration of eye fixations is important in predicting competitive behavior. However, as this is only one study, drawing definitive conclusions on this relationship should be done with caution. More research on this topic is needed.

In addition, in Study 1, the likelihood of defection was predicted by one's own gazing behavior but not by the counterpart's gazing. This contrasts with earlier work suggesting that being confronted by another's gaze leads to more social behavior (Baillon et al., 2013; Bateson et al., 2006; Ernest-Jones et al., 2011; Nettle et al., 2013; Northover, Pedersen, Cohen & Andrews, 2017). Still, the weaker predictive power of the other's eye gaze is not surprising, because here causality was more reliant on only one of the two directions (i.e., a counterpart's eye gaze can trigger competitiveness, but one's competitiveness is unlikely to affect the counterpart's own gazing).

Taken in combination, the present findings complement and expand our knowledge on eye gaze and competition. Building on previous work on the intrapersonal dynamics of gazing and behavior (Chen et al., 2013; Jarick & Kingstone, 2015), we hypothesized that the relationship between eye gazing and competitiveness is bi-directional and showed that competition influences eye gaze but, at the same time, gazing shapes the competitive behavior of the gazer. We advance that the origin of this bi-directional relationship is in the ingrained association between gazing and competition. Evolutionarily, the association between gaze and competition is a likely consequence of the dual function of gaze; in competitive environments it is important to both acquire information about the other and signal information about oneself (Gobel et al., 2015; Jarick & Kingstone, 2015). It is likely that repeated experience works to strengthen this association.

Future Research Directions

It remains an open question whether our findings generalize beyond mixed-motive situations. For example, on a first date, eye gaze may decrease competitiveness (Bolmont, Cacioppo, & Cacioppo, 2014). As hypothesized by Chen et al. (2013), the association between eye gaze and competitiveness may only arise in situations where there is some disagreement, conflict, or potential competition. In this light, group belongingness could also be a moderator as the associations of gazing might be different for in-group members than for outgroup members. Future research is needed to fully understand how social construal of the situation moderates the current findings.

Another potentially important question is whether eye gaze promotes a general competitive attitude or whether it only specifically triggers a competitive attitude toward the target of the gaze. If eye gaze promotes a general competitive attitude, there should be carry-over effects: fixating on one counterpart's eyes then increases competitive behavior in subsequent interactions with other counterparts. Findings from Tang and Schmeichel (2015) are consistent with this idea. The authors found that gazing at the eyes of several targets increased the tendency to act competitively with a different target in a subsequent interaction. Similarly, interacting in a competitive environment may lead a person to not only engage in more eye gazing in the present situation, but may also increase eye gazing in subsequent (otherwise neutral) interactions and hence, competitive intentions may indirectly carry-over through the mechanism of eye gaze. Further research is needed to better understand such potential effects.

Conclusion

Our results underscore that the relationship between physical markers and behavior is complex, with both variables influencing one another. Awareness of bodily states and actions affecting competition might help people to better understand others' intentions, as well as their influences on one's own behavior.

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