Personality and Social
Psychology Bulletin
2016, Vol. 42(12) 1666–1677

DOI: 10.1177/0146167216669124
pspb.sagepub.com
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The Eyes Are the Windows to the Mind: Direct Eye Gaze Triggers the Ascription of Others' Minds

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Abstract

Eye gaze is a potent source of social information with direct eye gaze signaling the desire to approach and averted eye gaze signaling avoidance. In the current work, we proposed that eye gaze signals whether or not to impute minds into others. Across four studies, we manipulated targets' eye gaze (i.e., direct vs. averted eye gaze) and measured explicit mind ascriptions (Study 1a, Study 1b, and Study 2) and beliefs about the likelihood of targets having mind (Study 3). In all four studies, we find novel evidence that the ascription of sophisticated humanlike minds to others is signaled by the display of direct eye gaze relative to averted eye gaze. Moreover, we provide evidence suggesting that this differential mentalization is due, at least in part, to beliefs that direct gaze targets are more likely to instigate social interaction. In short, eye contact triggers mind perception.

Keywords

eye gaze, mind perception, person perception, face perception

Received March 18, 2016; revision accepted August 9, 2016

Inferring the mental states of others is a skill central to social interaction and is of increasing interest to social and cognitive scientists. Several related literatures, including the literatures on dehumanization (e.g., Haslam, 2014; Haslam & Loughnan, 2014), infrahumanization (e.g., Leyens, Demoulin, Vaes, Gaunt, & Paladino, 2007; Leyens et al., 2000), and mind perception (Gray, Gray, & Wegner, 2007; Waytz, Gray, Epley, & Wegner, 2010), share a core theme: What motivates individuals to impute sophisticated, humanlike minds into some and withhold such sophisticated cognitive and emotional faculties from others?

This question of when sophisticated mental faculties are ascribed to others is important because the consequences of ascribing or withholding mind from others can be potent. Ascribing mind to others brings them into the moral community (Opotow, 1990), whereas denying mind often leads to perceptions of others as incapable of feeling sophisticated emotional states (Leyens et al., 2007), can lead to discrimination (Pereira, Vala, & Leyens, 2009), and potentiate aggression (Viki, Osgood, & Phillips, 2013).

Past research has identified multiple cues leading to the ascription or withholding of mind, including top-down processes such as desires for social connection (Epley, Akalis, Waytz, & Cacioppo, 2008) and bottom-up processes such as how faces are encoded (Deska, Lloyd, & Hugenberg, 2016; Hugenberg et al., 2016). In the current work, we build on these findings by exploring a novel domain: eye gaze. Being the recipient of others' direct eye gaze, or being unable to catch the gaze of another, has strong communicative signals of others' interest or disinterest in social interaction (e.g., Wirth, Sacco, Hugenberg, & Williams, 2010). Here, we argue that eye gaze is often used to determine the extent to which others' minds ought to be imputed. Others' gaze often portends social interaction, and so inferring others' mental states becomes important. Across four studies, we provide converging evidence indicating that targets displaying direct eye gaze are ascribed more sophisticated humanlike mental faculties.

To this end, we first briefly summarize recent findings on ascribing and withholding minds, before moving to a brief review of how eye gaze influences person perception. We then present four studies demonstrating that, compared with averted eye gaze targets, direct eye gaze targets cause perceivers to infer gazers have more sophisticated humanlike faculties (Study 1a, Study 1b, and Study 2), that the ascription of more sophisticated minds to direct eye gaze targets is related to beliefs about the increased likelihood of social interaction (Study 2), and that the effects of eye gaze on perceptions of mind are bounded by perceptions of a target's animacy (Study 3). Considering eye gaze as a trigger for mind ascription is, we believe, a novel theoretical contribution to the growing mind perception literature as well as related literatures, including nonverbal communication and face perception.

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Ascribing and Withholding Mind

Whereas the consequences of dehumanization have long been of interest to scholars (Kelman, 1976), the cognitive processes underlying ascribing and withholding personhood have only recently received greater scrutiny (see Bain, Vaes, & Leyens, 2014). A complete review of the various theories of dehumanization, mind perception, and similar constructs is beyond the scope of the current work. However, there is some consistency in how scholars from multiple research traditions—including the infrahumanization (Leyens et al., 2007; Leyens et al., 2000), dehumanization (Haslam, 2006, 2014), and mind perception (Waytz, Gray et al., 2010) literatures—explain when people ascribe sophisticated, humanlike faculties to others (see Bain et al., 2014, for a review). Indeed, all of these prominent perspectives focus on how humans are seen as possessing sophisticated capacities that are distinct from other animals, while having an emotional responsiveness and experiential capacity that makes humans distinct from inanimate objects, such as automata, machines, and robots (see Haslam, 2014).

Nonhuman animals, such as dogs and frogs, are seen as being able to experience the world and simple emotional states but have limited cognitive and agentic abilities; inanimate agents, such as robots, are seen as being able to cogitate and act upon the world but are lacking in inner experience (Gray et al., 2007). Only adult humans are seen as having sophisticated experiential and agentic capacities. Furthermore, this distinction between "unthinking" animals and "unfeeling" machines is reflected in how people are dehumanized. Humans who are seen as being emotionally responsive and socially engaged, but lacking rationality, morality, and civility, are seen as animal-like (animalistic dehumanization), whereas humans who are seen as being rational and civil, but lacking in emotional responsiveness and interpersonal warmth, are seen as machinelike (mechanistic dehumanization; see Haslam, 2006, 2014; Loughnan & Haslam, 2007).

When do we infer that others have such sophisticated mental faculties and when do we withhold them? Put simply, when it suits our purposes to do so. Past research has reliably demonstrated that ascribing such sophisticated mental faculties to agents is malleable and subject to perceivers' top-down motives (Waytz, Cacioppo, & Epley, 2010). For example, we are more likely to see others as cognitively and emotionally simplistic when it serves a self-protective function (Castano & Giner-Sorolla, 2006). As another example, the desire for social connectedness can cause increased likelihood that minds are ascribed to agents. Epley and colleagues (Epley, Akalis et al., 2008a) demonstrated that individuals who are chronically lonely or who are induced to feel momentary social isolation show an increased tendency to impute mind in technological gizmos and pets, and show an increase in reported belief in the supernatural (see also Aydin, Fischer, & Frey, 2010; Epley, Waytz, Akalis, & Cacioppo, 2008; McConnell, Brown, Shoda, Stayton, & Martin, 2011; McConnell, Lloyd, & Buchanan, 2016).

Similarly, the desire to have mastery over the environment (i.e., effectance motivation) leads people to ascribe sophisticated minds to entities, including entities that objectively have either unsophisticated minds or even no minds at all. For example, devices that appear relatively unpredictable or difficult to control are ascribed more sophisticated minds than their more controllable counterparts (Waytz, Morewedge et al., 2010). Such effects are particularly true for individuals chronically high in the dispositional need to have control, supporting this motivational argument (Epley, Waytz et al., 2008). For example, after watching a video of two dogs, one relatively more predictable than the other, individuals high in the desire for control were more likely to ascribe sophisticated humanlike faculties to the unpredictable dog.

In sum, the extant literature provides consistent evidence indicating that we are likely to ascribe or deny sophisticated humanlike faculties to others when it suits our needs. In the current research, we seek to extend this past research on motivated ascriptions of sophisticated minds to a novel motivational signal: eye gaze. To this end, we turn now toward a discussion of how direct and averted eye gaze influences person perception, with a particular focus on how being locked in another person's direct eye gaze may serve as a distinct motivator to begin imputing mind.

Eye Gaze and Person Perception

Of the various sources of nonverbal communication, few are as potent as eye gaze (Argyle, 2013; Kleinke, 1986). From the eyes, people glean a great deal of social information, especially information about others' intentions (Calder et al., 2002). The centrality of the eyes to social cognition has led humans to become sensitive to the eye regions of faces very early in development. Infants show sensitivity to the eyes of others from a very young age, preferring to attend to eyes relative to other parts of the face and body (Farroni, Csibra, Simion, & Johnson, 2002). In addition, infants are able to follow the eye gaze of others (Brooks & Meltzoff, 2002; Hood, Willen, & Driver, 1998), with the ability to discriminate direct from averted eye gaze occurring by 4 months of age (Vecera & Johnson, 1995). This tendency to favor others' eyes in visual attention is stable across the life span, and failure to demonstrate this capacity is often indicative of autism spectrum disorders (Mundy, Sigman, Ungerer, & Sherman, 1986).

Importantly, this tendency to attend to the eyes provides real information in social contexts (see Hugenberg & Wilson, 2013, for a review). People use others' eye regions to attribute mental states to them (see Fernandez-Duque & Baird, 2005) and to predict others' future behaviors (Nummenmaa, Hyönä, & Hietanen, 2009). Important to the current work, others' direct eye gaze signals their approach orientation: Targets that display direct eye gaze are more likely to socially engage (Cary, 1978). Eye gaze can also be used as a signal of dominance (Ellsworth, 1975), hostility, and anger (Argyle & Cook, 1976), all of which are approach-related nonverbal signals. Moreover, direct eye gaze facilitates the recognition of approach-related emotions, such as happiness and anger (Adams & Kleck, 2003, 2005). Direct eye gaze captures attention (Frischen, Bayliss, & Tipper, 2007), engages high-efficiency face-processing mechanisms (Young, Slepian, Wilson, & Hugenberg, 2014), facilitates face memory (Adams, Pauker, & Weisbuch, 2010; Mason, Hood, & Macrae, 2004), and increases the cognitive accessibility of social information (Macrae, Hood, Milne, Rowe, & Mason, 2002), supporting the prediction that direct eye gaze mobilizes resources in preparation for social interaction.

Furthermore, being locked in others' gaze prepares us physiologically for social interaction. Direct gaze triggers physiological arousal (Nichols & Champness, 1971), increased activity in the amygdala (Kawashima et al., 1999), and activation of approach-related brain systems (Hietanen, Leppänen, Peltola, Linna-aho, & Ruuhiala, 2008). In short, direct eye gaze signals that another person is likely to approach, and that social interaction is imminent. Direct gaze appears to bring online physiological arousal and other social-cognitive processes that may help prepare for the impending interaction, such as an approach orientation and the capacity to process others' faces efficiently.

Just as direct eye gaze signals interest, and triggers preparation for interaction, averted eye gaze signals disinterest. Work by Wirth and colleagues (2010) demonstrates that averted eye gaze produces feelings of ostracism and reduces perceptions of one's own relational value. A clever field experiment provides converging evidence for the notion that averted eye gaze signals ostracism. Wesselmann, Cardoso, Slater, and Williams (2012) demonstrated that the averted eyes of a passerby led to increased feelings of social disconnection relative to simple acknowledgment via direct eye gaze. Thus, when others avert their eye gaze from us, they are signaling disinterest and social disengagement, neither of which portends immediate social interaction.

Taken together, past research from multiple disciplines indicates that when we are the subject of others' direct eye gaze, this signals the gazer's relevance to the self, and that interaction is imminent. When others direct their eye gaze at us, they are signaling that they are likely to approach, either for confrontation or affiliation. Furthermore, the signal of direct eye gaze begins to mobilize a variety of resources in preparation for this impending interaction, ranging from physiological arousal to perceptual and cognitive mechanisms used for extracting information from others' faces. Extending from this, we propose that part of this preparation for social interaction triggered by direct eye gaze also involves imputing mental states into others. Indeed, part of the core function of being able to simulate others' minds is to understand what they want, and how we might successfully meet our own needs by fulfilling the needs of others (Humphrey, 1976). Thus, we propose that being subjected to the direct (vs. averted) eye gaze of others will make people more likely to ascribe sophisticated minds to them. To the extent that direct eye gaze causes us to prepare for social interaction, and effective interaction involves inferring the intents of others, we hypothesize that being the target of direct eye gaze will cause us to ascribe more mind into others, relative to being the target of averted eye gaze.

The Current Work

In the current work, we investigated the role of eye gaze on ascriptions of mind. We argue that perceivers likely do not engage the cognitive resources needed to simulate sophisticated mental states for others all of the time. Rather, only when social interaction appears likely do perceivers fully consider the complexities of others' minds. As discussed previously, eye gaze is a strong cue indicating the likelihood of social interaction. We argue that eye gaze can signal when one ought to expend the resources to simulate another's mind. Thus, we hypothesize that targets displaying direct eye gaze will be ascribed more sophisticated humanlike faculties than those displaying averted eye gaze. Moreover, we hypothesize that this tendency to ascribe mind to direct eye gazers, as compared with averted gazers, will be accounted for, at least in part, by the belief that the direct gazer seems likely to approach.

To test these hypotheses, we conducted four studies. In Studies 1a and 1b, participants viewed a series of human faces displaying direct or averted eye gaze and rated their perceived agentic and experiential capacities using a measure adapted from the literature on mind perception (Gray et al., 2007). In Study 2, we sought to replicate the pattern of findings observed in Studies 1a and 1b while also demonstrating that the increased mentalization of direct gaze targets would be accounted for by the belief that direct gaze targets were more likely to approach. Finally, in Study 3, we sought to demonstrate that the effects of eye gaze on mind perception were bounded to targets that were plausibly animate. To test this hypothesis, participants viewed faces morphed along a continuum from nonhuman (i.e., doll) faces to fully human faces in 10% increments (see Looser & Wheatley, 2010). Critically, we manipulated whether these faces displayed direct versus averted eye gaze on a within-subjects basis. Participants were asked to report the extent to which they believed each target had a mind. Across these studies, we find consistent, replicable, and novel evidence supporting the hypothesis that targets displaying direct eye gaze are ascribed more mind than those displaying averted eye gaze.

Studies 1a and 1b

In Studies 1a and 1b, we sought to provide initial evidence for the hypothesis that eye gaze influences ascriptions of mind. Here, participants viewed a series of faces that displayed direct or averted eye gaze. After seeing each face, participants responded to items assessing the degree to which targets had agentic and experiential capacities. Gray and colleagues (2007) provided evidence suggesting that there are two distinct dimensions of mind. Agency reflects the extent to which an entity is capable of planful action and willful self-regulation. Experience reflects the capacity to sense basic feelings, such as hunger and pain. Whereas infants or dogs are seen as able to feel but not to think, automata can think but not feel.

Based on this distinction, we hypothesized that direct gaze may more strongly affect the inference of agency than of experience. Direct eye gaze signals that an individual has an intent to approach, making it important to understand their goals in the impending interaction, and what they will do (i.e., their agency). It was less clear a priori whether perceptions of experience would be affected by eye gaze. Regardless of whether targets are gazing at us or not, humans should seem capable of basic sensations and drive states, such as feeling pain and experiencing hunger. Puppies and frogs share these same sensory capacities. Thus, in Studies 1a and 1b, we hypothesized that faces with direct eye gaze would be ascribed more agency than faces with averted eye gaze.

In Study 1a, participants rated the agentic and experiential capacities of faces displaying direct gaze and the same faces that were digitally manipulated to display averted gaze. We chose this approach because it holds constant the identity of the target. However, a weakness of Study 1a was that only averted gaze targets were digitally manipulated, confounding gaze direction with digital manipulation. Thus, in Study 1b, we digitally manipulated the eyes of both the direct and averted gaze targets to ensure direct versus averted gaze was not confounded with digital manipulation. Otherwise, both studies were procedurally identical.

Method

Participants. For Study 1a, a power analysis using G*Power to detect a small effect (η_p^2 = .05), assuming a .6 correlation between measures, targeted an *N* of 36 for 95% power. For Study 1b, we targeted the same number of participants. For this study and for all subsequent studies, our a priori stop rule was to collect until we reached or exceeded our targeted sample size. Data were not analyzed until data collection was completed. Forty-one mTurk workers (*M* age = 42.61, *SD* = 15.34) completed Study 1a and were remunerated US$0.40 for their participation. Most participants identified as White (87.8%) and 53.7% identified as female. A separate sample of 46 mTurk workers (*M* age = 38.20, *SD* = 12.91) completed Study 1b and were remunerated US$0.40 for their participation. Most participants identified as White (69.6%) and 52.2% identified as female. No participants were excluded from analysis in either study.

Materials. Stimuli for both Studies 1a and 1b consisted of 20 neutral expression White faces (10 female, 10 male) that were obtained from the Chicago Face Database (Ma, Correll, & Wittenbrink, 2015). In Study 1a, we used digital manipulation software to manipulate each target's eye gaze to be averted, creating a direct and an averted gaze version of each face. In Study 1b, we additionally digitally manipulated the direct gaze targets by first removing the pupils and then separately adding them back in. Thus, both studies had 40 stimuli, including direct and averted eye gaze versions of each face identity.

Procedure. After providing informed consent, participants in both studies were first instructed that they would see a series of faces, with each face appearing only briefly, and that after viewing each face, they would respond to a series of statements about that face.

Participants then completed 20 trials (i.e., 10 direct gaze, 10 averted gaze). Each trial began with the presentation of a stimulus face (500 ms). Whether a given face identity was displayed with direct or averted eye gaze was counterbalanced between subjects. Counterbalancing had no influence on the results. Face presentation order was randomized independently for each participant. After viewing each face, participants responded to eight items adapted from Gray and colleagues' (2007) mind dimensions. We used the four items that loaded most strongly on the agency dimension in the original Gray and colleagues' article (i.e., *this person is capable of exercising self-control, this person is capable of acting morally, this person has a good memory, this person is capable of recognizing emotions*; α = .89) and the four items that loaded most strongly on the experience dimension (i.e., *this person is capable of feeling hunger, this person is capable of feeling pain, this person is capable of feeling fear, this person is capable of feeling pleasure*; α = .96). Participants responded to each item using a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

After responding to all eight items for each face, participants were asked demographic questions (e.g., sex, age, race), were fully debriefed, and were provided their completion code to receive compensation. Compensation was not withheld from any participants.

Results

Study 1a. Of primary interest was whether eye gaze influenced attributions of agency and experience. To test this, we computed mean values for agency and experience, separately for faces displaying direct and averted eye gaze. These values were subjected to a 2 (eye gaze: averted vs. direct) × 2 (mind dimension: agency vs. experience) repeated-measures ANOVA (see Figure 1). As predicted, this analysis yielded a significant main effect of eye gaze, $F(1, 40) = 5.05$, $p = .03$, 95% confidence interval [CI] = [0.01, 0.02], $\eta_p^2 = .11$, such that targets who displayed direct eye gaze were ascribed more sophisticated mental faculties (*M* = 5.47, *SD* = 0.65) than targets who displayed averted eye gaze (*M* = 5.34, *SD* = 0.70). In addition, this analysis yielded a significant main effect of mind dimension, $F(1, 40) = 33.88$, $p < .001$, 95% CI = [0.53, 1.09], $\eta_p^2 = .46$, such that all faces were ascribed greater experiential capacity (*M* = 5.81, *SD* = 0.85) than agentic capacity (*M* = 5.00, *SD* = 0.71).

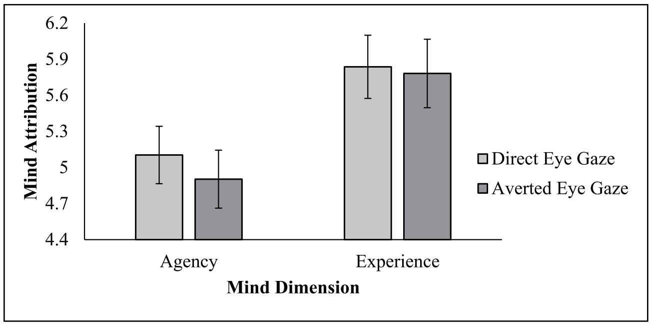

Figure 1. Participants' beliefs about targets' minds in Study 1a.
Note. Direct eye gaze targets were ascribed more agency than averted eye gaze targets. Error bars represent 95% CI. CI = confidence interval.

These lower order effects were qualified by an interaction between eye gaze and mind dimension, $F(1, 40) = 4.36$, $p = .04$, $\eta_p^2 = .10$. Pairwise comparisons revealed that faces with direct eye gaze were ascribed more agency ($M = 5.10$, $SD = 0.75$) than faces with averted eye gaze ($M = 4.90$, $SD = 0.76$), $t(40) = 2.47$, $p = .02$, 95% CI = [0.04, 0.37], $d = 0.39$. We observed no significant difference in ascriptions of experience between direct ($M = 5.85$, $SD = 0.83$) and averted ($M = 5.78$, $SD = 0.90$) eye gaze faces, $t(40) = 1.15$, $p = .26$, 95% CI = [−0.04, 0.15], $d = 0.18$.

Study 1b. Mean agency and experience values were subjected to a 2 (eye gaze: averted vs. direct) × 2 (mind dimension: agency vs. experience) repeated-measures ANOVA. This analysis yielded the predicted main effect of eye gaze, $F(1, 45) = 5.72$, $p = .02$, 95% CI = [0.02, 0.21], $\eta_p^2 = .11$, such that targets who displayed direct eye gaze were ascribed more sophisticated mental faculties ($M = 5.53$, $SD = 0.89$) than targets who displayed averted eye gaze ($M = 5.42$, $SD = 0.93$). In addition, this analysis yielded a significant main effect of mind dimension, $F(1, 45) = 38.06$, $p < .001$, 95% CI = [0.32, 0.63], $\eta_p^2 = .46$, such that all faces were ascribed greater experiential ($M = 5.71$, $SD = 1.01$) than agentic capacity ($M = 5.24$, $SD = 0.84$).

These lower order effects were qualified by an interaction between eye gaze and mind dimension, $F(1, 45) = 12.19$, $p = .001$, $\eta_p^2 = .21$. Pairwise comparisons revealed that faces with direct eye gaze were ascribed more agency ($M = 5.33$, $SD = 0.83$) than faces with averted eye gaze ($M = 5.15$, $SD = 0.90$), $t(45) = 2.96$, $p = .005$, 95% CI = [0.06, 0.30], $d = 0.44$. We observed no significant difference in ascriptions of experience between direct ($M = 5.73$, $SD = 1.01$) and averted ($M = 5.67$, $SD = 1.03$) eye gaze faces, $t(45) = 1.17$, $p = .25$, 95% CI = [−0.03, 0.12], $d = 0.17$.

Discussion

In Studies 1a and 1b, we sought to provide initial evidence demonstrating that direct eye gaze facilitates ascriptions of mind relative to averted eye gaze. Specifically, we hypothesized that targets displaying direct eye gaze would be ascribed more sophisticated mental states, and especially more agency, than their averted eye gaze counterparts. Our data support this prediction. Notably, our manipulation of eye gaze had no effect on ascriptions of experiential capacity, suggesting that the effects of eye gaze on mind ascriptions might be unique to beliefs about an individual's ability to planfully act and cogitate but not their ability to sense the world. Although this may seem like a surprise—knowing how others feel might provide some advantage in interaction—it is important to note that the measures in the experience dimension are really quite fundamental: feeling hunger, pain, pleasure, and fear. These are drive states and sensations shared among a variety of species, from humans to hummingbirds. Thus, that eye gaze does not substantially change our beliefs that other humans can experience hunger or pain, but does change our beliefs about their abilities to self-regulate and act planfully is perhaps a sensible outcome.

Importantly, Study 1b both conceptually replicates Study 1a and rules out a potential confound. One concern with Study 1a is that perhaps the digital manipulation of the averted gaze faces rendered them somehow unnatural or uncanny, which may have been the cause of the lowered ascriptions of mind. In Study 1b, both the direct and averted eye gaze targets were digitally manipulated. We replicated our results, while demonstrating that the digital manipulation alone cannot explain the observed effects.

To this point, we have argued that one possible reason why targets displaying direct eye gaze are ascribed more mind is because others' direct eye gaze can signal their likelihood to approach the self. A variety of evidence suggests that others' direct eye gaze can help mobilize resources in preparation for social interaction. Indeed, to the extent that a target is likely to interact with the perceiver, it may be in the perceiver's best interest to consider the intentions of the target. Study 2 was designed to more directly investigate this hypothesis.

Study 2

Study 2 had two primary objectives. First, we sought to provide a direct replication of Study 1a. Second, we wanted to provide evidence that the reason that others' direct eye gaze causes us to see them as more agentic entities is because direct eye gaze is a signal that direct gazers appear more likely to approach and engage the self in social interaction.

Thus, the methods and procedures of Study 2 were identical to those of Study 1a, except that participants were also asked two additional questions about each stimulus that were intended to assess the extent to which participants believed a target was interested in social interaction. As before, we hypothesized that direct eye gaze targets would be ascribed more sophisticated minds, and especially more agency, than averted eye gaze targets. In addition, we predicted that the differential ascription of mind to direct eye gaze targets would be mediated by participants' beliefs that the direct eye gaze targets were more likely to engage in social interaction with them.

Method

Participants. Because this study involved a direct replication of Study 1a, we targeted the same sample size. Forty-six mTurk workers (*M* age = 33.83, *SD* = 11.13) completed this study and were remunerated US$0.40 for their participation. Most (69.6%) participants self-identified as White, and females comprised 63.0% of our sample. We excluded eight participants who failed attention checks, leaving a final sample of 38. Including all participants does not change the nature of the effects.

Materials. We used the same stimuli in this study as in Study 1a.

Procedure. The procedure for the current study was identical to Study 1a, except for the following. In addition to responding to the eight mind dimension items (Gray et al., 2007), participants also responded to two items assessing how much they believed the target was interested in social interaction with the self (i.e., *This person is interested in engaging in a social interaction with you; This person is likely to approach you*). Participants responded to each item using a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Embedded in the survey were two additional items that served as attention check items. Specifically, one item instructed the participant to select *strongly disagree* and the other instructed the participant to select *strongly agree*. Failure to comply with these instructions was used as an indicator that participants were not paying attention and served as our exclusion criterion.

After responding to the mind attribution and social interaction questions for each face, participants provided basic demographic information, were fully debriefed, and were provided their completion code to receive compensation. Compensation was not withheld for any participants.

Results

Of primary interest was the extent to which direct and averted eye gaze faces differentially lead to ascriptions of agency and experience, and the extent to which such differential ascriptions of mind were related to beliefs about a target's likeliness to desire social interaction. We computed mean values for agency and experience separately for faces displaying direct and averted eye gaze. These values were subjected to a 2 (eye gaze: averted vs. direct) × 2 (mind dimension: agency vs. experience) repeated-measures ANOVA. As shown in Figure 2, this analysis yielded the predicted main effect of eye gaze, $F(1, 37) = 4.73$, $p = .04$, 95% CI = [0.01, 0.17], $\eta_p^2 = .11$, such that faces displaying direct eye gaze ($M = 5.17$, $SD = 0.66$) were ascribed more sophisticated minds than faces displaying averted eye gaze ($M = 5.01$, $SD = 0.71$). This analysis also produced a significant main effect of mind dimension, $F(1, 37) = 50.77$, $p < .001$, 95% CI = [0.50, 0.90], $\eta_p^2 = .58$, such that all faces were ascribed greater experiential ($M = 5.47$, $SD = 0.85$) than agentic capacities ($M = 4.77$, $SD = 0.60$).

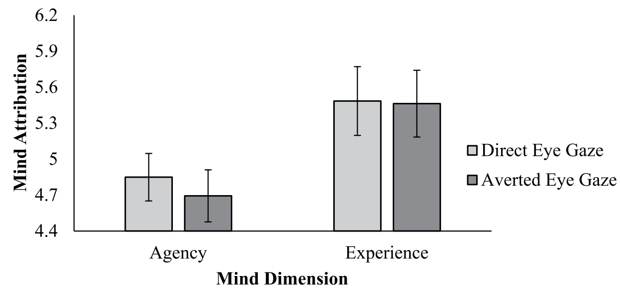

Figure 2. Participants' beliefs about targets' minds in Study 2.
Note. Direct eye gaze targets were ascribed more agency than averted eye gaze targets. Error bars represent 95% CI. CI = confidence interval.

These lower order effects were qualified by a marginally significant interaction between eye gaze and mind dimension, $F(1, 37) = 4.42$, $p = .07$, $\eta_p^2 = .09$. Although this interaction was marginally significant, it had nearly the same effect size as the interaction observed in Study 1a ($\eta_p^2 = .09$ vs. $\eta_p^2 = .10$). Therefore, we continued our probing of the nature of this interaction by conducting pairwise comparisons. Replicating Study 1a, these analyses revealed that direct eye gaze faces ($M = 4.86$, $SD = 0.60$) were ascribed more agency than averted eye gaze faces ($M = 4.69$, $SD = 0.66$), $t(37) = 2.49$, $p = .017$, 95% CI = [0.03, 0.28], $d = 0.40$. There was no significant difference on the experience dimension between direct ($M = 5.48$, $SD = 0.87$) and averted ($M = 5.46$, $SD = 0.85$) eye gaze faces, $t(37) = 0.48$, $p = .63$, 95% CI = [−0.07, 0.11], $d = 0.08$.

Next, we turned to our measure of perceived likelihood that the target desired social interaction. As expected, targets displaying direct eye gaze ($M = 4.05$, $SD = 0.93$) were seen as more likely to desire social interaction than targets displaying averted eye gaze ($M = 3.65$, $SD = 0.86$), $t(37) = 2.41$, $p = .021$, 95% CI = [0.06, 0.73], $d = 0.39$.

To provide evidence for the proposed mechanism—that the relationship between eye gaze and ascriptions of agency are accounted for, at least in part, by the perceived likelihood of social interaction—we tested whether likelihood of interaction mediated the effects of eye gaze on ascription of agentic capacities using Montoya and Hayes's (2016) *MEMORE* macro, which is used for within-subjects designs. Using 10,000 bootstrapped samples, the 95% CIs for the indirect effect of eye gaze on ascriptions of agency through perceived likelihood of social interaction did not contain zero, 95% CI = [0.01, 0.19], providing evidence for statistical mediation. In addition, when controlling for the effect of the mediator, the direct effect between eye gaze on ascriptions of agency is no longer significant, $t(37) = 1.33$, $p = .19$, 95% CI = [−0.04, 0.19].

Discussion

We had two primary goals with Study 2. First, we sought to provide a direct replication of Study 1a. Second, we sought to provide evidence for our prediction that the preferential ascription of mind is associated with beliefs that direct eye gaze targets are more likely to engage in social interaction, relative to averted eye gaze targets. The data support both predictions. Direct eye gaze targets were ascribed more agentic minds than averted eye gaze targets. In addition, direct eye gaze targets were seen as more likely to desire social interaction than averted eye gaze targets. Finally, providing evidence for the proposed mechanism, perceptions of the likelihood of social interaction mediated the relationship between eye gaze and ascriptions of agency. This suggests that the tendency to infer more sophisticated faculties for direct gaze targets appears due, at least in part, to a belief that these direct gaze targets are more likely to instigate interaction.

Notably, however, given that participants were viewing pictures of faces on a computer screen, no actual social interaction with the targets was possible. In spite of the direct gaze's increasing ratings of perceived intent, there was no actual prospect of subsequent interaction. These were pictures, not people. Because these effects obtain in the absence of the actual possibility for interaction, we believe that this likely provides an additional important insight into the current effects: They are potent and may well occur outside of conscious intent. Indeed, the effect of eye gaze on social cognition is sufficiently potent so as to reliably create effects in the absence of intent or even the physical presence of gazer. For example, attention to others' eye gaze occurs early in life and dominates attention to faces (see Frischen et al., 2007). Furthermore, gaze effects reliably occur in the physical absence of the gazer, even for important self-related outcomes. For example, past research shows that even a computerized avatar that refuses to gaze at the self is sufficient to injure self-esteem (Wirth et al., 2010), an effect quite similar to what occurs with an embodied other (Wesselmann et al., 2012). Thus, these results appear not to rely on the deliberative inference that an interaction is likely to occur, but likely occur spontaneously, and even when it is clear that an interaction cannot logically occur. This is an issue to which we return in the "General Discussion" section.

Study 3

The first three studies provide evidence suggesting that targets displaying direct eye gaze are ascribed more sophisticated mental faculties than targets displaying averted eye gaze. Moreover, our data suggest that this bias is due, in part, to beliefs that direct eye gaze targets are likely to engage in social interaction. However, the mere presence of direct eye gaze may not, by itself, be enough to believe that a face harbors a sophisticated mind. In other words, just because eyes garner attention and early processing, their mere presence does not guarantee the presence of a mind. Does the direct eye gaze of an inanimate doll make the doll appear to have more mind, or is the effect unique to plausibly animate targets? We hypothesize that the effects of eye gaze on mentalization are likely bounded to fully animate agents—Although the direct eye gaze of dolls may catch our attention, it likely does not produce heightened mind ascription.

Indeed, in their seminal work on subjective perceptions of animacy, Looser and Wheatley (2010) demonstrated that as targets become increasingly humanlike, they are seen as correspondingly more animate. In their work, participants saw a series of stimuli from a doll-to-human morph continuum (e.g., 100% doll/0% human; 90% doll/10% human, through 0% doll/100% human) and judged the likelihood that each target was animate (i.e., had a mind). As noted above, as targets became more human, they were rated as more likely to be animate; however, these effects were nonlinear. Rather, judgments of animacy fit a sinusoidal curve, suggesting that the perception of animacy has a clear, categorical boundary. Subjectively speaking, animacy has a "tipping point." Thus, targets either appear animate or they do not (see also Deska, Almaraz, & Hugenberg, 2016; Hackel, Looser, & Van Bavel, 2014). However, in past work, stimuli always displayed direct eye gaze. Importantly, whereas even directly gazing doll faces appear sufficient to trigger the face detection system, they do not elicit the sustained processing typical of human faces (Wheatley, Weinberg, Looser, Moran, & Hajcak, 2011). They may create the perceptual experience of a face, but we hypothesize they will not begin to mobilize us for an impending interaction.

In Study 3, we used these same doll-to-human morph stimuli and asked participants to rate targets on perceptions of mind. We hypothesized that it would require an objectively greater proportion of human features for participants to ascribe mind to faces displaying averted relative to direct eye gaze. In other words, the average *point of subjective equality* (PSE; Looser & Wheatley, 2010)—the point at which participants are equally likely to say a target has or does not have mind—would be shifted further toward the human end of the morph continuum for averted eye gaze targets. In addition, we hypothesized that although we would replicate the tendency for direct eye gaze to trigger mentalization, this effect would be limited to faces that are past the "tipping point of animacy" (i.e., past the PSE). Indeed, even when displaying direct gaze, an inanimate target is incapable of social interaction; thus, direct gaze from a doll should be insufficient to trigger mind ascription.

In Study 3, participants viewed face stimuli that varied along a morph continuum from nonhuman to human. Half of the targets displayed direct eye gaze and half displayed averted eye gaze. Participants were asked to rate the extent to which they believed each target has a mind. We hypothesized that faces displaying direct eye gaze would be rated as more likely to possess a mind, relative to averted eye gaze targets.

However, we predicted that this effect would only emerge for those faces that were objectively high in humanness (i.e., past the PSE) so as to be plausibly animate.

Method

Participants. We used G*Power to estimate how many participants we would need with an estimated effect size η_p^2 = .06, with an assumed correlation between measures of .8 (values derived from Study 1; Deska et al., 2016). This suggested a target *N* of 44 for 95% power. To account for potential data loss as in Study 2, 60 participants (*M* age = 34.58, *SD* = 11.21) were recruited via mTurk and were remunerated US$0.40 for their completion of the experiment. Most participants identified as White (81.7%) and 60.0% identified as female. No participants were excluded from the analysis.

Materials. Our stimuli were comprised of a subset of the morphed images used in past research (Hackel et al., 2014; Looser & Wheatley, 2010).[1] Eight human faces served as base stimuli. These faces were morphed with nonhuman face-like stimulus (i.e., a structurally similar doll face). Each face was morphed in 10% increments along the morph continuum, producing 11 images for each face identity (i.e., ranging from 0% human/100% doll to 100% human/0% doll). Eye gaze was manipulated such that each identity had a direct and averted eye gaze version at every morph level, creating 176 stimuli in total.

Procedure. After providing informed consent, participants were informed that they would be seeing a series of faces, some of which may seem more human and some of which may seem less human. Their task was to rate whether each target has a mind. In keeping with past research (Hackel et al., 2014), we asked our participants to "think about how a human mind is different from that of an animal or robot."

Participants were then shown, one at a time, all 11 faces from the eight face identities. Half of the faces were presented with direct eye gaze and half with averted eye gaze. Whether a given identity-morph-level stimulus displayed direct or averted eye gaze was counterbalanced between subjects. This counterbalancing had no effects on the subsequent analyses. Presentation order of face identities was randomized for each participant. After seeing each face, participants responded to one item assessing mind attribution. Specifically, participants were asked, "Does this face definitely have a mind?" They responded to this item using a 7-point scale ranging from 1 (*definitely does not have a mind*) to 7 (*definitely does have a mind*).

After responding to the mind attribution item for each face, participants were asked to provide demographic information, were fully debriefed, and were provided their completion code to receive compensation. Compensation was not withheld for any participants.

Results

We conducted two separate analyses to test our hypothesis of whether direct eye gaze targets were rated as having sophisticated humanlike minds, relative to averted eye gaze, and whether these ratings differed across the doll-to-human morph continuum. We first investigated whether the average ratings of mind differed across the morph continuum for direct versus averted eye gaze. We then analyzed the PSEs for direct and averted eye gaze.

Average mind ratings. Of primary interest was the extent to which eye gaze interacted with the objective humanness (i.e., morph level) of the stimuli to influence mind attribution. To investigate this, we computed mean values for the mind attribution item separately for direct and averted eye gaze faces at each level of face morph. These values were subjected to a 2 (eye gaze: averted vs. direct) × 11 (morph level) repeated-measures ANOVA. This analysis yielded a main effect of eye gaze, $F(1, 59) = 6.16$, $p = .016$, 95% CI = [0.03, 0.29], $\eta_p^2 = .10$, such that faces with direct eye gaze were rated as more likely to possess mind (*M* = 3.40, *SD* = 0.88) than faces with averted eye gaze (*M* = 3.24, *SD* = 0.84). This analysis also yielded a main effect of morph level, $F(10, 590) = 318.47$, $p < .001$, $\eta_p^2 = .84$, such that as faces increased from 0% human to 100% human, they were perceived as more likely to have mind.

These lower order effects were qualified by the predicted interaction between eye gaze and morph level, $F(10, 590) = 2.01$, $p = .03$, $\eta_p^2 = .03$ (see Figure 3). Beginning at 70% human morphs (past the average PSE), direct eye gaze targets were ascribed more mind than their averted eye gaze counterparts, *p*s < .015, *d*s > 0.32.[2] Conversely, direct and averted eye gaze targets that were less than 70% human were not differentially ascribed mind, *p*s > .08, *d*s < 0.23.

PSE. Of additional interest was the extent to which the PSE was shifted further from the midpoint for averted compared with direct gaze faces. To analyze this, participants' mind ratings were averaged across morph and fit to cumulative normal functions separately for direct and averted eye gaze stimuli. Conceptually replicating past work on ascriptions of mind to morph-continua stimuli (Looser & Wheatley, 2010), the PSE was shifted past the midpoint for faces displaying both direct (*M* = 0.59, *SD* = 0.20), $t(59) = 3.56$, $p = .001$, 95% CI = [0.04, 0.15], $d = 0.93$, and averted eye gaze (*M* = 0.62, *SD* = 0.18), $t(58) = 5.33$, $p < .001$, 95% CI = [0.08, 0.17], $d = 1.39$. As hypothesized, the PSE was further from the midpoint for averted compared with direct gaze faces, $t(58) = 2.67$, $p = .01$, 95% CI = [0.01, 0.07], $d = 0.35$.

Given our prediction that direct gaze would elicit greater ascriptions of mind for stimuli past the PSE, we conducted a separate analysis in which we tested morph levels 0% to 60% against morph levels 70% to 100% for averted and direct gaze

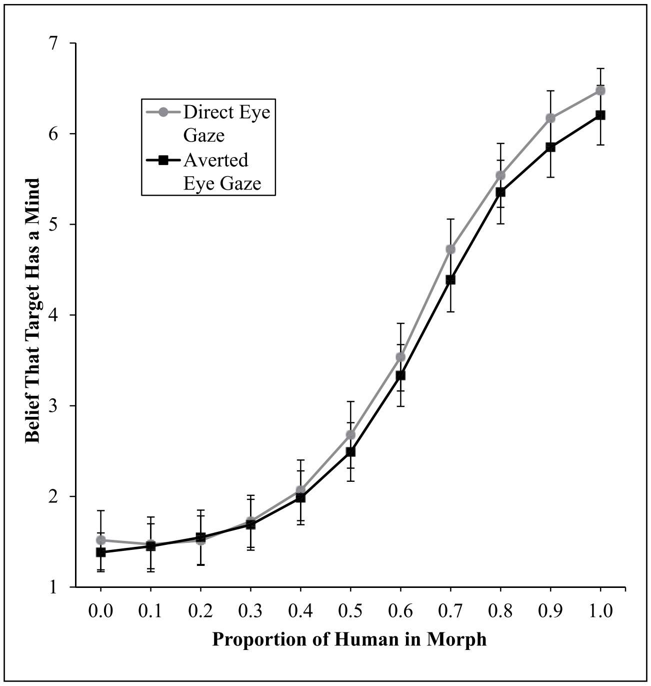

Figure 3. Participants' beliefs about targets' minds in Study 3.
Note. Participants were more likely to ascribe mind to direct eye gaze than averted eye gaze targets, but only when targets had an objectively strong signal of humanness. Error bars represent 95% CI. CI = confidence interval.

faces. Mean values were submitted to a 2 (eye gaze: averted vs. direct) × 2 (PSE: less than 60% vs. greater than 70%) repeated-measures ANOVA. Mirroring the previous results, this test yielded a main effect of eye gaze, $F(1, 59) = 7.89$, $p = .007$, 95% CI = [0.05, 0.31], $\eta_p^2 = .12$, such that faces with direct eye gaze were rated as more likely to possess mind ($M = 3.90$, $SD = 0.86$) than faces with averted eye gaze ($M = 3.72$, $SD = 0.86$). This analysis also yielded a main effect of PSE, $F(1, 59) = 436.23$, $p < .001$, 95% CI = [3.22, 3.90], $\eta_p^2 = .88$, such that faces on the human side of the PSE were rated as more likely to possess mind ($M = 5.59$, $SD = 1.10$) than below PSE ($M = 2.02$, $SD = 1.00$). These lower order effects were qualified by an interaction between eye gaze and PSE, $F(1, 59) = 4.82$, $p = .03$, $\eta_p^2 = .08$. For faces past the PSE, those displaying direct eye gaze ($M = 5.73$, $SD = 1.10$) were ascribed more mind than their averted eye gaze counterparts ($M = 5.45$, $SD = 1.20$), $t(59) = 3.22$, $p = .002$, 95% CI = [0.11, 0.45], $d = 0.42$. Conversely, direct ($M = 2.07$, $SD = 1.10$) and averted ($M = 1.98$, $SD = 0.97$) eye gaze targets that were below the PSE were not differentially ascribed mind, $t(59) = 1.23$, $p = .20$, 95% CI = [−0.05, 0.23], $d = 0.16$.

Discussion

The goals of Study 3 were twofold. First, we sought to conceptually replicate the previous findings using new stimuli, a new method, and a new measure. Second, we sought to demonstrate that the effects were not due to the mere presence of direct eye gaze but were sensitive to the nature of the gazer. We hypothesized that the effects would be bounded to clearly human targets.

As predicted, although participants in Study 3 believed that targets displaying direct eye gaze were more likely to possess a mind, these beliefs were moderated by the human–doll ratio in the morphed stimuli. Only when targets were sufficiently similar to humans so as to be past the "tipping point of animacy" did direct eye gaze produce an amplified belief that targets had mind. That eye gaze's effects on mind ascription were bounded by targets' perceived animacy is consistent with our logic. Direct eye gaze is a powerful signal of approach orientation. However, painting eyes on a rock makes it no more likely to engage in social interaction. Our data show that when displaying direct eye gaze, even humanlike stimuli that are perceived as inanimate are not seen as any more likely to possess a mind than the same target with averted eye gaze. To the extent that inanimate targets cannot ever generate social interaction, eye gaze should not signal that a target has a mind worth imputing.

General Discussion

Ascribing mind to another agent is an important act of social cognition. However, we likely do not contemplate the sophisticated inner life of every passerby. Rather, we may reserve such sophisticated cogitation for targets deemed self-relevant. In the current work, we argue that eye gaze is used as just such a signal.

Across four studies, we provide consistent evidence for the hypothesis that targets displaying direct eye gaze are ascribed more sophisticated minds than their averted gaze counterparts. Moreover, we provide evidence suggesting that such sophisticated minds are ascribed to direct eye gaze targets because, in part, these targets are perceived as likely to engage in social interaction. Finally, we show that the effects of eye gaze on beliefs about whether a target has mind are bounded by perceptions of animacy.

We believe that this research has implications for our understanding of both mind perception and of related phenomena such as autism. First, we believe that the current work approaches the topic of mind perception from a somewhat different perspective than much past work. For instance, most work in the mind perception literature (e.g., Waytz, Cacioppo et al., 2010) has focused on applying humanlike minds to nonhuman entities (i.e., anthropomorphism), or focusing on how human minds differ from nonhuman minds (e.g., Gray et al., 2007). Conversely, most work in the dehumanization literature (e.g., Haslam & Loughnan, 2014) has focused on actively denying fully human minds to fellow humans. Implicit in these approaches are two critical insights. First, nonhuman entities do not have sophisticated minds, but can be treated like they do when it suits our motives. Second, humans do have sophisticated minds, but can be treated like they do not when it suits our motives. Although we strongly agree with these insights, in the current work, we instead show that minds are actively imputed into humans when we need them. We adopt a functional perspective on mind ascription—Inferring the complex mental states of others is, itself, likely a complex process, and one that is not undertaken unless it is needed. Others' thinking is for our doing.

Beyond this, we believe that the current work may also have implications for research investigating autism. One of the hallmark features of autism is the relative inability to use eye gaze to infer the mental states of others (Baron-Cohen, Campbell, Karmiloff-Smith, Grant, & Walker, 1995; Pelphrey, Morris, & McCarthy, 2005). The current work suggests that not only does eye gaze influence ascriptions of mind for neurotypical people, but that this effect is due in part to the ability to infer that a target may be interested in social interaction and to distinguish between animate and inanimate entities. Recent work (New et al., 2010) shows that people with autism are not impaired in their ability to distinguish between animate and inanimate targets; however, deficits in social interaction comprise the core features of autism. Thus, theory of mind deficits associated with autism may have more to do with deficits in social interaction than in issue pertaining to veridical perceptions of animacy. From our perspective, it may not be entirely coincidental that individuals with chronic deficits in inferring the mental states of others also have impairments in their ability to use eye gaze to gather social information.

Future Directions

We have demonstrated the effects of eye gaze on mind ascription across multiple studies, and yet there are still many unanswered questions. First, it remains unclear how the context or valence of the impending social interaction might moderate these findings. Eye contact might mean that an individual is interested in striking up friendly conversation, but it may just as well as have aggressive overtones. Arguably, understanding intentions are important in either case, yet our stimuli involved only neutral expression faces, absent context. This could be considered a strength of the current design; even absent overt contextual cues, participants in our studies tended to ascribe mind more readily to those with direct gaze than with averted gaze. Nevertheless, it will be important in future research to investigate whether similar effects occur when perceivers believe the impending interaction to be positive or negative. Indeed, it is plausible that believing a negative interaction may occur may lead to the active suppression of others' minds.

Second, the current research does not address how eye gaze effects such as these may interact with intergroup phenomena; much real-world dehumanization occurs in intergroup contexts (Leyens et al., 2007). We believe that a strength of the current work is that differential ascription to mind occurred even holding group signals (e.g., race) constant. Yet, it remains unclear how eye gaze might interact with group processes to predict mind ascriptions. Perhaps members of threatening outgroups who display direct gaze are dehumanized even more than their averted eye gaze counterparts because direct gaze may signal threat. Alternatively, direct gaze might mobilize the resources required to impute mind, inhibiting dehumanization processes often seen in intergroup contexts. Certainly, future work is needed to further elucidate how eye gaze affects mentalization in intergroup contexts.

Finally, our argument that people consider the minds of direct gazers because of the likelihood of social interaction may seem at odds with the fact that all targets in the current work were static images presented on computer screens. In none of our studies was there an actual possibility of future interaction, nor were participants led to believe there would be. If so, why do such effects occur? We argue that the fact that the effects did emerge speaks to the potency of eye gaze as a signal. It seems that eye gaze is an automatic mobilizer—When direct eye gaze from a human face is encountered, we automatically begin mentalizing the target in preparation for interaction. Indeed, a rich research tradition supports the potency and automaticity of eye gaze. From birth, humans have the ability to discriminate between direct and averted gaze (Farroni et al., 2002), and even 4-month-old infants are capable of discriminating between direct and averted gaze on schematic faces (Vecera & Johnson, 1995). Moreover, following others' gaze is observed in infants as young as 3 months old, even when stimuli are images presented on computer screens (Hood et al., 1998). Thus, although participants never interact, or even believe they will interact, with the stimuli in our work, our data are consistent with the rich tradition of research on eye gaze showing its vital and automatic role in human sociality. Yet even this automatic mobilization is bounded—The mere presence of eyes is not sufficient. In Study 3, we found that clearly inanimate objects (i.e., dolls) are not subject to the effects observed for human faces. This, too, is perhaps not a surprise. Whereas doll faces can activate the face and eye detection systems, the faces of inanimate objects (e.g., dolls) do not generate the sustained processing typical of actual human faces (e.g., Wheatley et al., 2011). Nevertheless, future work is needed to show how the effects of eye gaze on mind ascription might be moderated by live interactions. Indeed, perhaps the current effects would be magnified by the presence of an actual prospective interaction partner.

Concluding Remarks

Eye gaze is a potent communicative signal. The current work provides converging evidence using multiple methods to demonstrate that ascriptions of sophisticated humanlike minds to others are modulated by eye gaze—targets displaying direct eye gaze are ascribed more sophisticated minds than their averted gaze counterparts—and this differential ascription of mind is related to expectations of social interaction. In short, perceiving minds is functional to the extent that they can guide social interaction.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by National Science Foundation Grant BCS-1423765.

Supplemental Material

The online supplemental material is available at http://pspb.sagepub.com/supplemental.

Notes

1. The authors thank Jay Van Bavel for sharing stimuli.
2. The paired comparison between the direct and averted eye gaze targets was nonsignificant at the 80% human/20% doll morph level, $p = .22$, $d = 0.16$.

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