# FAMILIARITY, GAZE CUING, AND THE SELF

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Familiarity, Gaze Cuing, and the Self

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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# ABSTRACT

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Attention researchers have known for over a decade that people have a tendency to shift their attention automatically to a location gazed at by another person (e.g., Friesen & Kingstone, 1998). This social orienting appears to be reflexive in nature, and yet it also seems to be influenced by contextual factors and individual differences (for a review, see Frischen & Tipper, 2007). In the present document, I investigated how the familiarity of the gaze cue provider influences individuals' tendency to shift attention to a gazed-at location. The main questions addressed in the research are: (1) What is the role of familiarity in responding to gaze direction? and (2) If an effect of familiarity is observed, does it generalize to the situation of orienting in response to one's own gaze direction? My results indicated that participants did orient to a gaze cue provided by their own face, as well as to gaze cues provided by the faces of a friend and a same-sex stranger. Findings which address the roles of the familiarity of the gazing face and of individual differences (i.e., self-esteem, autistic tendencies) among participants will also be discussed.

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TABLE OF CONTENTS

# LIST OF FIGURES

Figure Page

# INTRODUCTION

An old proverb elegantly states that the eyes are the window to the soul, giving clues for empathy, deception, and intention. One's eyes communicate an abundance of information. We use the eyes to identify their owner, to infer feelings, and to help understand what the person is trying to say. In addition, eye gaze allows us to infer where another person's attention is directed.

From an evolutionary standpoint, it is beneficial to be able to follow another's gaze. For instance, if you are a chimpanzee wandering in the jungle, it is vital to notice if a fellow chimp suddenly averts its gaze, in case that gaze shift signals the presence of an approaching enemy. It is also important to notice if that chimpanzee breaks eye contact and turns to a different location, because this may indicate the opportunity for a tasty afternoon snack. Thus, the act of following another's gaze allows for acquisition of important information.

There is evidence that eyes are particularly special in humans. The human eye is different from the eyes of other primates because of the large amount of sclera (lighter-colored area) surrounding the darker colored iris (Kobayashi & Kohshima, 2001). Kobayashi and Kohshima investigated the "unique morphology" of the human eye by studying the eyes of 88 different primate species. They found that the human eye does in fact have the largest area of exposed sclera in comparison to other species. Kobayashi and Kohshima suggested that this makes it easier for others to detect gaze direction, something that would have been beneficial for early humans as they engaged in social activities important to their survival such as cooperative hunting. Kobayashi and Kohshima also found that in comparison with other primates, only humans had eyes with white sclera and

a dark iris. In most of the other nonhuman primates studied, the sclera was found to be mostly brown or light brown. Determining the direction of the eyes is difficult when the contrast between the iris and sclera is minimal. However, it has been suggested that for humans, gaze direction can be computed quickly and easily by using a simple rule: dark in the center of the eyes denotes eye contact, dark to the left means looking left, and dark to the right means looking right (Emery, 2000).

The fundamental importance of eyes is also suggested by the fact that humans are sensitive to information about eyes at a very early age. For example, babies prefer looking at eyes over other face features (Maurer, 1985), and can differentiate gaze directions by the age of 3 months (Hains & Muir, 1996).

Gaze following, the tendency to orient attention to where someone else is looking, develops at an early age in humans. It has been discovered that infants as young as 2 months (Scaife & Bruner, 1975) to 4 months old (Vecera & Johnson, 1995) are able to follow head-turns or changes in eye gaze direction. Butterworth and Jarrett (1991) state that another's gaze is informative because it "specifies the *possibility* of an object *somewhere* in visual space" (p. 70), and that this informativeness may be why gaze-following is learned so early in life.

Social attention

Gaze following involves reading directional information from another person's eyes and also perhaps generating expectations about the possibility of an interesting object or event in the environment. However, whether the other person and the viewer share the same *attentional space* depends on whether they attend to the same object. When an individual follows another's gaze, a joint attention relationship may be reached. Emery

(2000) states that "joint attention requires that two individuals... are attending to the same object... based on one individual using the attention cues of the second individual" (p. 588). In other words, joint attention is different from gaze following in that joint attention directs attention to a specific object in the environment (Frischen, Bayliss, & Tipper, 2007). Emery et al. (1997) state that "joint attention [thus] requires extra computation to process the object of attention, not just the direction of the gaze" (p. 286). Therefore, this action would indicate a higher cognitive process versus a reflexive or instinctual act. In gaze following, the individual may simply be oriented in the general direction of the gaze. Even though these two processes are different, they both play important roles in attention and acquiring information about the environment.

A key to successful social interaction is the ability to correctly interpret another's actions. Thus, being able to follow social cues such as another person's gaze direction and infer goals, intentions, and emotions from the eyes is of great social importance. According to Baron-Cohen (1995), children experience a "meeting of the minds" with another person when they attend to other people's eyes and follow their gaze to an object of mutual interest. From infancy through adulthood, humans develop what Baron-Cohen refers to as a "mind-reading system" that allows for interpretation of other people's thoughts and actions.

The first component of Baron-Cohen's system is the intentionality director (ID) which interprets stimuli in terms of their desires and goals. For example, you can infer that a shark is chasing a small fish because it 'wants' to eat it. The second component is the eye-direction detector (EDD) which detects the presence of eyes or eye-like stimuli. The EDD also computes direction of eye gaze (based on position of iris and sclera) and is able to attribute the psychological state of 'seeing' to a person whose eyes are directed towards

another object. Baron-Cohen states that by the time an infant reaches 9 months, the ID and EDD are fully functional (Baron-Cohen, 1995).

The third component is the shared attention mechanism (SAM) which identifies when the self and other are attending to the same object or location. Baron-Cohen (1995) referred to this type of event as a 'meeting of the minds'. In other words, it is the recognition that you and another person are engaging in the same mental state of attending to something else. The final component is the theory of mind mechanism (ToMM) which is able to deduce a range of mental states from observable behaviors and can incorporate the knowledge into a theory that can explain and predict another's behavior. Baron-Cohen's model stresses that the ability to use gaze direction to establish joint attention is vital to the development of the ToMM.

The gaze following and joint attention studies discussed above were all developmental studies examining the behavior of infants. However, during the past decade, the tendency of adults to align their attention automatically with that of others has become a subject of interest in the field of attention research. Researchers have been measuring the time course of attentional orienting to gaze direction in the laboratory, and have been comparing its properties with those of traditional forms of orienting in response to nonsocial attentional cues.

Attentional orienting

In spatial attention research, two types of orienting have traditionally been identified: exogenous and endogenous. Exogenous orienting occurs when a cue is suddenly presented at a location other than the current point of fixation. Attention is "captured" by this stimulus and is drawn to the cued location, thus facilitating a response to a target that

subsequently appears at that location. Exogenous orienting is automatic and reflexive in nature, and it occurs even when the cue location is nonpredictive of the target location (Frischen, Bayliss, & Tipper, 2007; Posner, 1980). In contrast, endogenous orienting is under voluntary control and is not automatic in nature (Frischen, Bayliss, & Tipper, 2007; Posner, 1980). It is usually produced by centrally-presented cues indicating a location where the target is likely to occur (e.g., predictive arrows, predictive words such as "RIGHT" and "LEFT"), and semantic processing is often required for the cue to produce orienting (Frischen, Bayliss, & Tipper, 2007; Langdon et al., 2006).

In addition, there are two types of cues: central and peripheral. A cue is central when it is located at the center of the screen, which is the fixation point for the participant. In contrast, peripheral cues are presented at some distance from the fixation point. It had been assumed for decades that only nonpredictive peripheral cues could cause reflexive (exogenous) orienting and that only predictive central cues could induce volitional (endogenous) orienting. However, relatively recently it was discovered that nonpredictive centrally-presented gaze cues could elicit reflexive orienting (Friesen & Kingstone, 1998). From this finding, the research on gaze-triggered orienting quickly became popular in the field of spatial attention research. Most of the gaze-cuing studies have used a modified version of the Posner (1980) cuing paradigm in order to examine social orienting effects.

In a typical example of the Posner (1980) cuing task, participants are instructed to fixate on a cross in the center of a screen. A centrally-located arrow cue appears in place of the fixation cross. Following the presentation of the arrow, a target appears to the left or right of the arrow cue. The participant's task is to respond to the onset of the target stimulus by making a speeded keypress response. In Posner and colleagues' (1980) study,

participants were told that the cue would be predictive of where the target would appear. In other words, if the arrow cue pointed to the right, it was likely that the target would appear to the right of the arrow. When a target is presented at the location indicated by the cue, the experimental trial is considered to be a "valid" or "congruent" trial; when the target is presented at the opposite location to that indicated by the cue, the trial is considered to be "invalid" or "incongruent". Through decades of research, it has been established that individuals are faster to respond to targets appearing in the cued location than in the uncued location (e.g., Posner, 1980); that is, responses are facilitated on valid compared to invalid trials.

Gaze-triggered attentional orienting

Orienting to social cues has been studied using a modified version of the Posner (1980) cuing paradigm described above. Typically, a face gazing to the left or right serves as the central cue. However, the gaze cue is not predictive of target location. The first gaze cuing study was conducted by Friesen and Kingstone (1998). These researchers used schematic faces with pupils directed straight ahead, to the left, or to the right with varying stimulus onset asynchronies (SOAs) between the presentation of the cue and target. As in a standard Posner cuing paradigm, a target appeared on either side of the centrally-located face. In this particular study, the participants were told that gaze direction was not predictive of where the target would be. Friesen and Kingstone found that eye gaze served as facilitative cue when the target was presented at the gazed-at location. These findings led attention researchers to question their prior beliefs about spatial cuing. As stated earlier, it had been believed that nonpredictive peripheral cues would trigger reflexive orienting towards the target and that predictive central cues would induce volitional orienting.

However, the faces with averted gaze served as a central *and* nonpredictive cue that produced a reflexive shift of attention (Friesen & Kingstone, 1998).

An investigation by Driver et al. (1999) used photographs of a real face whose eyes were averted to either the left or the right. The stimuli were displayed with varying SOAs between the presentation of the cue and target. Consistent with Friesen and Kingstone (1998), the gaze cue was nonpredictive of where the target would be located. Driver and colleagues also found that reaction times were faster for congruent trials. That is, when the target appeared at the gazed-at location, responses were faster than when the target appeared at the location opposite to where the stimulus face was looking, even though the gaze cue was nonpredictive. Together, these studies laid the foundation for gaze cuing studies by demonstrating automatic shifts of attention in response to a central, nonpredictive gaze cue.

Contextual effects on gaze-triggered orienting

Gaze-triggered orienting appears to be reflexive in nature; however, compared with reflexive orienting to nonpredictive central cues, reflexive orienting to gaze appears to be more easily influenced by top-down factors, such as the emotional expression on the gaze cue provider's face and the social identity of the gazer. In this sense, gaze direction may be "special" as an attentional cue because of the socially-relevant nature of the information that it provides.

Emotional expression. If a gazing face displays an emotional expression, will the expression affect performance in a spatial-orienting task? A brief introspection suggests that gaze-triggered orienting should be influenced by the observed facial expression. For example, a fearful gazing face might indicate the location of a threat in the environment,

and therefore might elicit a faster attention shift compared with a gazing face with a neutral expression. However, behavioral cuing studies have failed to consistently demonstrate an influence of emotional expression on gaze-triggered orienting when reaction time is used as a measure of response (Frischen, Bayliss, & Tipper, 2007)

Pecchinenda, Pes, Ferlazzo, and Zoccolotti (2008) investigated whether the presence of an evaluative goal is necessary for facial expression and gaze direction to have an effect on spatial attention. Pecchinenda and colleagues presented happy, disgusted, fearful, and neutral faces that gazed nonpredictively to the left or right in a spatial cuing paradigm similar to the gaze cuing studies described above. Affective words (i.e., positive and negative words) were used as peripheral targets, and the participants' task was to evaluate the words as positive or negative with a speeded keypress. In Experiment 1, faster reaction times were observed when positive target words were preceded by faces with a happy facial expression, and slower reaction times were observed when negative target words were preceded by faces with a negative expression. The researchers noted that the slower reaction times for the negative faces could be explained because of the complex features of the eyes, nose, and mouth that one must encode when looking at the face. These features are more intricate than a distinctive smile, which is much easier to encode. More importantly, however, significant gaze-cuing effects were found only with the negative faces.

Pecchinenda and colleagues' (2008) Experiment 2 was a control experiment that utilized a perceptual task rather than an evaluative task. Participants were shown the same happy, disgusted, fearful, or neutral gazing faces. Half of the target words were presented in lowercase letters and the other half were presented in uppercase letters, and the

participants' task was to judge letter case. The results in Experiment 2 differed from those in Experiment 1, with faster responses overall, but no interaction between the gaze cuing effect and emotional expression: the gaze cuing effect was significant for all expressions, and smaller than it had been for the negative faces in Experiment 1. Pecchinenda and colleagues concluded that contextual factors such as having an evaluative goal can influence reflexive gaze-triggered orienting.

Furthermore, Bonifacci, Ricciardelli, Lugli, and Pellicano (2008) concluded from a gaze cuing study in which the response task was to make an eye movement to a peripheral target that different combinations of gaze direction and facial expression can have different impacts on behavioral responses. Bonifacci and colleagues found that gaze direction, regardless of the type of face it appeared on (i.e., angry or neutral), tended to elicit automatic gaze-following behavior. This was indicated by the high percentage of saccade errors on invalid compared to valid trials. Moreover, it appeared that angry gazing faces demanded more attentional resources, which led to greater interference with overt attentional shifts (i.e., more saccade errors). On the other hand, the results suggested that a gazing face with a neutral expression can either elicit automatic gaze-following behavior, or be inhibited, resulting in an appropriate number of saccades to targets.

Identity of the gaze provider. Does the identity of the cue provider influence reaction time performance on spatial-orienting tasks? Quadflieg, Mason, and Macrae (2004) used different directional cue providers in order to compare attentional orienting in a group of college students. They compared the effects of nonpredictive directional cues using both animate objects (the face of a human or chimpanzee) and inanimate objects (a glove or an apple) with superimposed schematic faces. Directional cues were also varied in

the experiments: both eyes and arrows were presented as cues to indicate where the target might occur. The main question was simple: would a gaze cue provided by another species or an inanimate object trigger a shift in attention? Through a series of three experiments, Quadflieg and colleagues found that it did not matter who or what was providing the gaze cue. In other words, it did not matter whether the cue provider was animate or inanimate. It was not entirely surprising that humans respond to gaze cues from other species (see Deaner & Platt, 2003). However, it *was* a novel finding that humans can orient to directional cues from inanimate objects. These results suggest that gaze-triggered orienting may occur via a low-level mechanism for encoding eyes as social attention cues.

Another interesting discovery was that participants responded more quickly to eye gaze cues than to the arrow cues that were presented in place of the eyes (Quadflieg et al., 2004). In light of these results, it may be concluded that eyes serve as a more powerful cue than arrows, which are biologically irrelevant cues in comparison to eyes. Consistent with these results, Friesen, Ristic, and Kingstone (2004) also found that eyes elicited a more robust orienting effect than arrows.

Frischen and Tipper (2004) also examined whether the identity of the face would influence the cuing effect, but in a different manner. In previous studies, the same face was repeatedly shown, which may have caused habituation to the stimulus. Thus, if there is less attentional encoding of repeated faces, then it is possible that gaze-triggered orienting effects may decline. On each trial, participants were presented with a different face, for a total of 168 faces. It was thought that if a new face was observed on each trial, participants would engage their attention with the faces for longer periods of time. However, the presentation of different faces had no impact on gaze cuing. This suggests that there may

be separate neural mechanisms responsible for face identity processing and gaze-triggered orienting. These results also match with those of Hoffman and Haxby (2000) who demonstrated in an fMRI study that when people process faces in terms of identity or gaze, different neural structures appear to be involved. Specifically, the inferior occipital gyrus (IOG) and lateral fusiform gyrus (LFG) were involved in processing identity and the superior temporal sulcus (STS) and intraparietal sulcus (IPS) were involved in processing gaze. It can be concluded from these studies that there appears to be some dissociation between identity processing and gaze processing. However, these regions have an overlapping factor: all areas (IOG, LFG, STS, and IPS) show a greater response to faces than to other objects (Hoffman & Haxby, 2000; Kanwisher et al., 1997).

Deaner, Shepherd, and Platt (2007) also investigated the impact of the identity of cue provider in relation to gaze-triggered orienting, but they manipulated the familiarity of the gaze cue provider to participants in the real world (rather than manipulating familiarity over the course of the experiment). Specifically, the hypotheses were that familiarity would enhance gaze cuing in women because they tend to be more sensitive to social cues, and that women would show greater cuing effects in general (Deaner et al., 2007). Half of the participants were students in the neurobiology department ("departmental" participants) and the other half were not ("non-departmental" participants). The stimulus faces were photographs taken of six males in the neurobiology department. On each trial, a face appeared for 200, 400, or 800 ms. Images of the various faces with eyes averted to the left or right, or with eyes closed, were presented randomly. Following the offset of the face, participants were asked to indicate the location of the target, which appeared to the left or right of the centrally-presented face.

Deaner et al. (2007) found that female departmental participants showed the largest cuing effects and, not surprisingly, were more familiar with the gaze models than were non-departmental participants. At the 200 ms SOA, female departmental subjects had a greater cuing effect (26 ms) compared with the male departmental subjects (12 ms), and triple in comparison to male and female non-departmental subjects (9 ms). In other words, familiarity enhanced gaze cuing in women. These results suggest that social knowledge can be integrated into neural pathways that control gaze cuing. Furthermore, they are consistent with the pattern of females generally showing greater sensitivity to social cues than males (see Bayliss, diPellegrino, & Tipper, 2005; Geary, 1998).

Individual differences in gaze-triggered orienting

Although gaze cuing appears to be a strongly-ingrained reflex, there are some groups of individuals who do vary in how they respond to gaze cues. Research has shown that gaze cuing is affected in individuals with autism. Moreover, differences in gaze-triggered orienting have been observed in clinical and non-patient populations: individuals with schizophrenia (Langdon et al., 2006), individuals high in anxiety (Mathews et al., 2003), individuals high in trait fearfulness (Tipples, 2006), and also individuals low in self-esteem (Wilkowski, Robinson, and Friesen, 2009).

Autism. Autism is a developmental disorder characterized by deficits in verbal and nonverbal communication skills, deficits in social interaction, and impairments in processing social and emotional information (DSM-IV; American Psychiatric Association, 1994). Other signs of autism are an "absence of use of social smile, lack of facial expression, lack of responsiveness to parents' voices or attempts to play and interact, and lack of spontaneous imitation" (Jemel, Mottron, & Dawson, 2006, p. 94). Impairments in

social functioning include abnormalities in the use of information from the gaze direction and facial expression of others. It has been suggested that autistic individuals are not able to use gaze cues in the same manner as normal children (Baron-Cohen, Baldwin, & Crowson, 1997). Typically-developing children are able to detect direct eye contact faster than averted gaze whereas autistic children are quick to detect both types of gaze (Senju, Yaguchi, Toyo, & Hasegawa, 2003). However, it has been noted that children with autism make little eye contact whatever the context may be (Frischen, Bayliss, & Tipper, 2007).

Ristic et al. (2005) recruited a group of high-functioning autistic individuals and a matched group of normally-functioning individuals to investigate the effects of predictive and nonpredictive gaze cues. The group of normally functioning individuals shifted their attention in response to the perceived gaze direction both when it was predictive *and* when it was nonpredictive of target location. However, the group of high-functioning autistic individuals shifted their attention in response to eye direction only when gaze was predictive. This supports the notion that autistic individuals are not sensitive to the social relevance of eyes, even though they are sensitive to changes in event probabilities in their environment (Ristic et al., 2005).

Self-esteem and dominance. Humans have a need to interact with and be accepted by others (Baumeister & Leary, 1995). When individuals are unable to successfully integrate themselves into a social situation, it is theorized by social psychologists that a self-regulatory system becomes activated (Gardner, Pickett, Jefferis, & Knowles, 2005; Leary, 1999). When this system is activated, a number of things are said to occur: (a) one's level of social acceptance (versus rejection) is appraised. They may ask themselves, "Do I have a need to belong to this social group?"; (b) if one's self-esteem level is detected to be

low, the system allows the individual to establish a means of maintaining the social relationship by increasing one's sensitivity to social cues such as eye contact and facial expression; and (c) the detection of these social cues leads the individual to become more aware of their current social situation, thus facilitating interaction and increasing the likelihood of social acceptance (Gardner et al., 2005).

A recent study by Pickett, Gardner, and Knowles (2004) investigated one's need to belong and sensitivity to social cues. The researchers randomly split the participants into groups and manipulated the state of social belongingness (i.e., social inclusion or social exclusion). Participants who were socially excluded during a task rated their need to belong higher than those who had not been socially excluded. The participants who endorsed a higher need to belong were subsequently more sensitive to (and more accurate in identifying) facial expressions and vocal tones than those who did not see themselves as craving a need for acceptance. Leary (1999) theorized that the "sociometer" of an individual monitors the social environment, providing information about where they stand in relation to their social status, acceptance, or self-worth. When a rejection or exclusion episode occurs, an individual's self-esteem level plummets. This information is relayed back to the sociometer, bringing attention to one's need to belong. This prompts the individual to alter his or her behavior in order to be accepted. Pickett et al. (2004) stated, "At the most basic level, the purpose of the social monitoring system is to attune individuals to information that will help them navigate the social environment more successfully." (p. 1096).

A recent study by Wilkowski, Robinson, and Friesen (2009) has tied an individual's level of self-esteem to gaze-cuing effects. Social psychological research has established

that humans have an inherent need to be accepted by others (Baumeister & Leary, 1995). It has been theorized that humans have a "belongingness self-regulation system dedicated towards the maintenance of social inclusiveness" (Wilkowski et al., 2009, pg. 3). This theoretical system is regulated through the individual's interpretation and continuous monitoring of their social situation, which results in the individual changing their behavior to avoid future negative experiences, such as rejection. In other words, this system is regulated by feelings of low self-esteem, which let the individual know they must increase their efforts to maintain social relationships.

Wilkowski et al. (2009) examined whether gaze-triggered orienting effects were related to low levels of trait self-esteem. Participants completed a gaze cuing task in which a simple circle and line representation of a face was presented. As expected, responses were faster to validly cued targets than to invalidly cued targets. After the gaze-cuing task, participants were given the Rosenberg (1965) self-esteem scale as a measure of trait self-esteem. Each participant indicated on a scale from 1 (very inaccurate) to 5 (very accurate) how well ten different statements described themselves. The results matched the hypothesis: individuals low in self-esteem demonstrated a significantly greater cuing effect than individuals high in self-esteem. In other words, individuals with low self-esteem seem more sensitive to another's gaze as a reference for where they should allocate their attention. This finding is consistent with the "sociometer theory" (Leary, 1999) in which low self-esteem increases monitoring of the surrounding social environment. If individuals with low self-esteem are particularly sensitive to social information, it makes sense that they would be faster to shift attention in response to another's gaze than someone with high self-esteem, who may have less of a need to conform, or belong to a group.

Another individual difference associated with self-esteem is one's tendency to be dominant or submissive. Iizuka (1992) studied a group of extraverted college students and a group of introverted students. The extraverted individuals were more likely than the introverted individuals to maintain a longer mutual gaze while listening in a social conversation. Kalma (1992) found that in a group of male strangers, the ones who emerged as leaders in the group showed a prolonged gaze pattern. These findings suggest that extraversion and dominance are related to eye contact and gaze following. Similar results have been observed with nonhuman primates. Shepherd, Deaner, and Platt (2003) found that low-status rhesus macaques would reflexively follow the gaze of all familiar rhesus macaques, whereas high-status macaques would only follow the gaze of other high-status macaques. This suggests that gaze-triggered orienting can vary according to social status.

The self and one's own face

Many studies have addressed the concept of the self (see Lachter, Forster, & Ruthruff, 2004; Moray, 1959; Shapiro, Caldwell, & Sorensen, 1997). Research has consistently shown that materials that relate to the self (e.g., one's own name or face) tend to capture one's attention (Devue & Bredart, 2008). According to Bredart, Delchambre, and Laureys (2006), self-relevance is "a property that makes self-related stimuli particularly prone to attract one's attention as revealed by behavioural responses" (p. 46). The "self" is encountered several times a day, whether through a glimpse in the mirror or a private thought communicated to oneself. We spend 24 hours, 7 days a week with ourselves, even though we may not always be aware of it. Because of this constant "state of being" which we refer to as the "self", it is not difficult to understand why self-referential stimuli are so potent.

Attentional processing of one's own face

To test the robustness of self-referential stimuli using one's own face, Tong and Nakayama (1999) had participants search for their own face or a stranger's face in a visual search task. Tong and Nakayama found that participants were faster to recognize their own face (611 ms), as compared to an unfamiliar face (688 ms). This pattern held true irrespective of whether the face was presented at front or profile view, upright or upside-down, or with or without hair. The researchers suggested that we have a processing advantage for our own face because we develop "robust representations" for faces with which we have extensive experience (Tong & Nakayama, 1999). In this case, practice *does* make perfect in the sense that the more time we spend with an object or image, the more familiar we are with it; thus it is easier to detect.

In a recent study by Bredart, Delchambre, and Laureys (2006), participants and one of their same-sex classmates had a photograph taken of their face. The participant's face and their friend's face were presented as distractors in an attention task. The task consisted of congruent or incongruent trials in which the name of the participant or the classmate would appear next to one of the photos. The photo would either be congruent with the name (e.g., own face - own name) or incongruent with the name (e.g., classmate's face - own name). The instructions were to classify the target name as being their own name or the classmate's name as quickly as possible, while ignoring the face distractor. Results indicated that participants had shorter reaction times to their own name ($M$= 602 ms) than to their classmate's name ($M$= 626 ms), but on incongruent trials were more distracted when their self-face was shown. The results of this study are consistent with those of Tong

and Nakayama (1999) in suggesting that one's own face receives special or preferential processing.

Devue and Bredart (2008) reinvestigated the ability to ignore one's own face in an attention task. This time, they tested whether one's own face was harder to ignore than the face of an unfamiliar person. They suspected that the presentation of one's own face would serve as a momentary distractor. In addition to the presentation of one's own face and an unfamiliar face, a familiar other's face (e.g., a same-sex friend) was also used. The familiar face was added to determine how much of the distraction was due to the presentation of one's own face *per se,* as opposed to the familiarity of one's own face. The experimental task was to perform a digit-parity task (deciding if two numbers presented on the screen are odd or even) and to ignore a face that was presented at the same time. In one experiment, the distractor face was presented in the center of the screen and the digit pair was presented either to the left or the right of the face. In a second experiment, the distractor face was presented in the periphery and the digit pair was presented centrally.

The results of the first experiment indicated that the self-face was only marginally effective in producing a distracting effect compared with the stranger's face. The distraction was only minor due to habituation of the self-face image after several trials. Thus, the distracting effects of the self-face and the familiar other's face were similar in terms of overall reaction times, suggesting the self-face was not particularly powerful in grabbing participants' attention. But in the second experiment, the presentation of the self-face in the peripheral position led to a temporary shift in attention towards the face once the participants had mastered the digit parity task in the latter half of the experiment. During Experiment 2, participants had no need to attend to the distractor face presented in the

periphery to complete the digit parity task. In other words, participants were able to follow the instructions to ignore the peripheral faces in the first block of Experiment 2. However, as the participants became more comfortable with the task, they were momentarily distracted by their own face, as reflected in longer reaction times in Block 2 of Experiment 2. Devue and Bredart (2008) concluded that the self-face had no enduring distracting power when it was presented at central fixation, but that it *was* momentarily distracting. In addition to this, the centrally-presented self-face was not found to be more distracting than the face of another familiar person. This suggests that the allocation of attention was influenced by the familiarity of the to-be-ignored face rather than by the self-referential aspects of the face. These results are consistent with the gaze cuing study of Deaner et al. (2007), which also found that the familiarity of the face presented has an effect on performance. Devue and Bredart also concluded that the self-face can be temporarily distracting when located near the participant's focus of attention. Together, these results suggest that one's face may not be as potent a distractor as was previously thought.

Perceptual asymmetry of one's own face

The perception of one's own face in a photograph is noticeably different from the image one sees in the mirror. This is because our faces are asymmetrical; and unlike a photograph, which yields a "true" image of what things look like, a mirror yields a reverse image. To appreciate this, one need only imagine the case of wearing a t-shirt with written words on it: the words look normal when someone takes a photograph of us wearing it, but when we stand in front of the mirror the words are reversed.

Bredart (2003) stated that the "visual experience of ourselves derives mainly from self-inspection in mirrors" (p. 805). Although we mainly see our faces in mirrors, it is not

unusual to see ourselves in family photographs. Bredart (2003) also reminds us that even though we come across the normal pictures of ourselves, these images are more common than seeing a familiar other's face as they would appear in the mirror. In reality, we rarely see other people's faces as they would appear in the mirror. Thus, if we are presented with a true-image photo and a mirror-image photo of our own face, it might be more difficult to recognize our own true image in comparison to the mirror image. And if we are presented with a mirror-image photo of a familiar other, the difference in difficulty compared with viewing a true image of the familiar other might be even greater.

This image discrepancy was first studied by Mita, Dermer, and Knight (1977). Mita and colleagues had participants choose which of two photographs they preferred. One photograph was of a mirror image of the participant's face and the other was a true image. A friend was also asked to choose which of the two images they preferred. The researchers found that the participants preferred their own mirror images over their true images. However, the participants' friends preferred the true images. The friend would not see the participant's mirror image on a regular basis, so it is intuitive that they would prefer the true image of their friend's face. This finding was also replicated in other studies such as Bredart (2003), Brady, Campbell, and Flaherty (2004, 2005), and in part by Ishibashi and Kita (2007). While it is not surprising that we would choose the image we are most familiar with, the relationship between familiarity and the perceptual asymmetry of faces is an important aspect that should be considered when using faces of individuals and their familiar others as experimental stimuli.

Summary. The eyes are a powerful cue for indicating feelings, intentions, and the location of a gazer's attention. The eyes are so powerful that even very young infants

respond to deviated gaze. There is evidence for an intricate social attention system in which attention to gaze direction is affected by top-down factors such as emotional expression and identity, and yet there is also evidence for a low-level mechanism which does not seem to be affected by contextual information.

Current Study

Attention researchers have provided evidence that our tendency to shift attention to a gazed-at location is fast and automatic, but some studies have also demonstrated that gaze-triggered orienting can be influenced by social contextual factors such as the gazer's emotional expression and identity. To date, however, researchers have not investigated the attentional response to gaze when the cue provider is highly familiar, nor have they investigated the attentional response to gaze when one's own face (perhaps the most familiar face of all) provides the directional gaze cue. Although we perceive an image of our own face daily in the context of glancing in a mirror, in the real world it is not physically possible for us to use our own gaze direction as a directional cue. Comparing the gaze cuing effects of an unfamiliar face and a familiar face will reveal the role of familiarity in social orienting, and comparing the gaze cuing effects of a familiar face and one's own face will provide evidence concerning whether any familiarity effect observed is moderated by context or is relatively insensitive to identity and meaning.

The main questions addressed by the present study are: (1) what is the role of familiarity in responding to gaze direction? and (2) If an effect of familiarity is observed, will it generalize to the nonsensical situation of orienting in response to one's own gaze direction? The following study examined participants' orienting to gaze cues provided by images of a stranger's face, a familiar other's face, and their own face. I predicted that

participants would demonstrate a "normal" cuing effect for the stranger's face, and perhaps an enhanced cuing effect for the familiar other's face. I did not have a prediction for the self-face. The experimental trials were presented in three sets. In one set, a stranger's face was the gaze cue provider. In the second set, the participant's friend served as the gaze cue provider. And in the third set the participant's own face served as the gaze cue provider. The gaze provider types (self, familiar other, and stranger) were presented both as true images and as mirror images, so that the potential effects of facial asymmetry on familiarity could be explored. In addition, because individual differences in gaze-triggered orienting have been identified in relation to autism, self-esteem, and dominance, participants filled out questionnaires designed to assess those differences. Individual personality differences were analyzed with respect to cuing effects. These measures are all relevant to the question of how individuals perceive and respond to the self and others, and to social cues.

# METHOD

## Participants

Forty students and faculty members (females = 25, males = 15) from North Dakota State University participated in the study. Participants ranged in age from 18 to 57 years of age (*M* age = 25.7 years, *SD* = 8.44 years). Participants were recruited through flyers posted around campus and through an online sign-up system. All participants were required to be 18 years of age or older and have normal or corrected-to-normal vision. Individuals were either compensated with $10 or were awarded one point of participation credit for every 15 minutes they were involved in the study (4 points were received for participation in this study). Participants were recruited in pairs of the same sex so that each participant served as the "familiar other" for the other participant. Each participant read and signed a consent sheet prior to participation.

## Materials

Apparatus: The experiment was run on an IBM-compatible desktop computer with an Intel Pentium 4 CPU 2.8 GHz processor using Presentation software (Neurobehavioral Systems). Stimuli were presented on a 16-inch monitor running at a refresh rate of 85 Hz. Responses were collected with a serial response box (Psychology Software Tools). Photographs were taken using a Canon Powershot S51S digital camera.

Experimental Stimuli: The basic stimuli consisted of photographs of three different types of faces (the face of the participant, the same-sex friend's face, and a same-sex stranger's face) gazing to the left and gazing to the right. The face stimuli were acquired with a digital camera (Canon Powershot S51S). Each face photograph was in a full frontal orientation taken in front of a black backdrop. All photographs of participants were taken

under the same lighting conditions and in the same room setting. The photographs were edited using Photoshop™ to create uniformity with the other images. The face images were cropped using the same mask layout.

For each participant, each of the face images (three identities x two gaze directions) was mirrored, producing a total of 6 face images for each pair of participants. A total of 2 strangers (1 man and 1 woman) were used for the experiment. These were selected by the researcher from a small library of undergraduates' faces acquired from other participants prior to the study.

The face stimuli were presented in the center of the monitor on a gray background. The face images subtended approximately 8.3° wide and 12.2° high. The target stimuli demanding identification were a black "X" and an "O", subtending approximately 1.5° wide by 1.5° high. The target appeared centered with respect to the center of the eyes approximately 8 cm to the left or right of the stimulus face on the screen. A 1° gray cross served as a central fixation point at the beginning of each trial.

Questionnaires: The questionnaires completed by participants were: the Friendship Quality Questionnaire, (FQQ, Parker & Asher, 1993) the Autism-Spectrum Quotient (AQ, Baron-Cohen et al., 2001), Rosenberg's (1965) self-esteem scale, and an adapted measure for assessing interpersonal dominance (Gough, McClosky, & Meehl, 1951).These scales are presented, respectively, in Appendices D-G.

The Friendship Quality Questionnaire assesses one's perceptions of their friendship with another person. The FQQ was modified from a 40-item to a 21-item self-report questionnaire which included revised items that appropriately reflected the age group of the participants. The questionnaire is based on a 5 point Likert scale ranging from 1 (not at all

true), to 5 (really true). Six qualitative aspects of friendship were measured: validation and caring, conflict resolution, conflict and betrayal, help and guidance, companionship and recreation, and intimate exchange. Additional questions were included to assess one's current perception of their relationship with the friend (e.g., "On a scale from 1 to 5, how close are you and your friend?", "How long have you known your friend?"). The FQQ was scored by averaging across the items that make up each subscale. Individuals ranged in the subjective closeness with their partner from being not at all close to very close ($M = 2.9$, $SD = 0.71$). Partners knew each other anywhere from 3 months to 20 years.

The Autism-Spectrum Quotient is a brief, self-administered instrument for measuring autistic tendencies. The AQ consists of 50 statements (e.g., "I find it easy to 'read between the lines' when someone is talking to me") that participants rated on a scale from 1 (definitely agree) to 4 (definitely disagree) indicating how well the statement described themselves. The items assess 5 different areas: social skills, attention switching, attention to detail, communication, and imagination. Normal individuals who begin to display some autistic tendencies score around 16. Intermediate levels of autistic tendencies are seen at scores of 20+, and individuals who score 32+ are considered to have autism (Baron-Cohen et al., 2001). It is important to note that none of the participants in the current study scored a 32+ on the AQ, which is the cut-off for clinically significant levels of autistic characteristics. The overall mean on the AQ was 17.2 out of 50 ($SD = 5.7$), which is within normal range. Seventeen of the forty participants scored over 17. The reliability of the measure was high ($\alpha = .80$).

The Rosenberg self-esteem scale asked participants to indicate how well ten statements (e.g., "I feel that I have a number of good qualities.") characterize themselves,

using a 1 (strongly agree) to 4 (strongly disagree) scale. Five items are reverse-scored. The scores are determined by averaging the items. An alpha was calculated for all 10 items and this revealed a low reliability ($\alpha = .34$). I examined a correlation matrix for the items and found that 3 of the items were negatively correlated with the remaining items. Therefore, these items were dropped from the measure. Doing so greatly improved the reliability of the measure ($\alpha = .76$).

The Interpersonal Dominance Scale was modified from an instrument created by Gough, McClosky, and Meehl (1951). The 32-item Likert-based scale was developed by choosing statements that represented social skills, assertiveness, and personal confidence. Individuals are asked to rate on a 1 (strongly disagree) to 7 (strongly agree) scale to the extent to which the statement describes themselves. The reliability of the measure was high ($\alpha = .74$)

Design

The experiment consisted of a target identification task, requiring the participant to identify an "X" or an "O" in the periphery as quickly and as accurately as possible. The experiment consisted of three stimulus sets, which were counterbalanced across participants. One set of trials presented a stranger's face as the gaze cue provider. The other set of trials presented the self-face as the gaze cue provider. A third set of trials presented the friend's face as the gaze cue provider. There were 576 test trials (3 blocks of 64 trials for each cue identity), and 24 practice trials (8 practice trials for each identity set) for a total of 600 test trials. Half of the trials had a gaze-cue onset to target onset SOA of 100 ms and the other half had an SOA of 600 ms. For each identity, there were equal numbers of valid trials (e.g., face gazing to the left, target appearing to the left) and invalid trials (e.g.,

face gazing to the left, target appearing to the right). Half of the time the face was a true image, and half of the time it was a reverse (mirror) image. The target type was equally likely to be an "X" or "O" and was equally likely to appear at the left location and right location. The within-subject variables of primary interest were: SOA (100 ms, 600 ms), cue identity (self, familiar other, stranger), and cue validity (valid, invalid).

Procedure

Participants came in with their same-sex friend to the experiment. The experimenter had each participant will fill out a consent form (Appendix A or B) and an ethnicity form (Appendix C). After completing the paperwork, each participant was photographed. The photograph session and editing process took approximately 5-10 minutes for each pair of participants. Each face photograph was in a full frontal orientation taken in front of a black backdrop while the participant was seated in a stationary chair. Participants were asked to assume a neutral expression and were told to gaze at left and right focal points placed about 45 degrees at eye level on each side of the participant. Participants with long hair or bangs were asked to tie or hold back their hair in order to reduce asymmetries and extraneous visual details.

Participants received verbal instructions about the task from the experimenter. They were informed of the sequence of events on each trial and instructed to maintain central fixation at the location of the fixation cross at all times. For each participant, the fixation point was placed at the location of the face's nose (i.e., near, but not exactly at the center of the screen). Participants were told that the gaze direction of the face was not predictive of the target location and that their primary task was to press the corresponding key on the response box as quickly and accurately as possible in response to the identity of the target.

Participants were asked to rest their chin and forehead on a desk-mounted headrest positioned at eye level approximately 57 cm from the monitor (the chair height was adjusted for the participant's height). The chin rest was placed in such a manner that the participant's eyes were centered with the computer monitor. After completing a series of practice trials, they were allowed to ask questions before beginning the test trials. Participants were instructed to rest their eyes between blocks of trials, and to initiate each new block by pressing a key on the response box. They were also instructed to blink in between trials. Participants' eye movements were monitored informally during the experiment by a research assistant.

On each trial, the fixation cross appeared in the center of the screen for 500 ms. A face then appeared with the eyes averted to either the left or the right. Then, after 100 ms or 600 ms, a target ("X" or "O") appeared in the left or right periphery. The target remained on the screen until a target identification response had been made or until 1000 ms had elapsed. Gaze direction, target location, target identity (X or O), image orientation (true or mirror), and SOA (100 ms or 600 ms) were selected randomly and with equal probability within each block. Following the experimental task, participants completed a series of questionnaires (Appendices D-G). Responses were acquired using the keyboard for three of the questionnaires. The final questionnaire (FQQ) was completed by using a pen and paper.

# RESULTS

## Gaze-Cuing Experiment

Errors. Participants with an overall mean error rate greater than 10% were excluded. Data from two participants were excluded by this criterion. Anticipations, incorrect responses, and timed-out trials were classified as errors and were excluded from the data analysis. Anticipations were defined as responses with a latency of less than 100 ms. Trials were considered timed-out if no response was given within 1000 ms of target presentation (i.e., before the end of the trial). Anticipations made up 0.026% of all trials, incorrect responses made up 3.22% of all trials, and timed-out trials made up 0.53% of all trials. Because these rates were so low, errors were not analyzed further.

Response Time Analysis. A repeated measures within-subject ANOVA with SOA (100 ms, 600 ms), cue identity (self, stranger, familiar other) and cue validity (valid, invalid) was conducted with median RT as the dependent variable. The means of the median response times for each condition are illustrated in Figure 1.

A significant main effect was found for cue validity, $F(1, 39) = 16.91, p < .0005$. Participants responded more quickly to the target when it appeared at the gazed-at location (valid trials) in comparison to when it appeared at the opposite location (invalid trials). A main effect for SOA was detected, $F(1, 39) = 145.18, p < .0001$ with shorter RTs at the longer (600 ms) SOA, which reflects a standard foreperiod effect (Bertelson, 1967; Friesen & Kingstone, 1998). Finally, there was a significant main effect for cue identity $F(2, 39) = 3.27, p < .05$, which is illustrated in Figure 2.

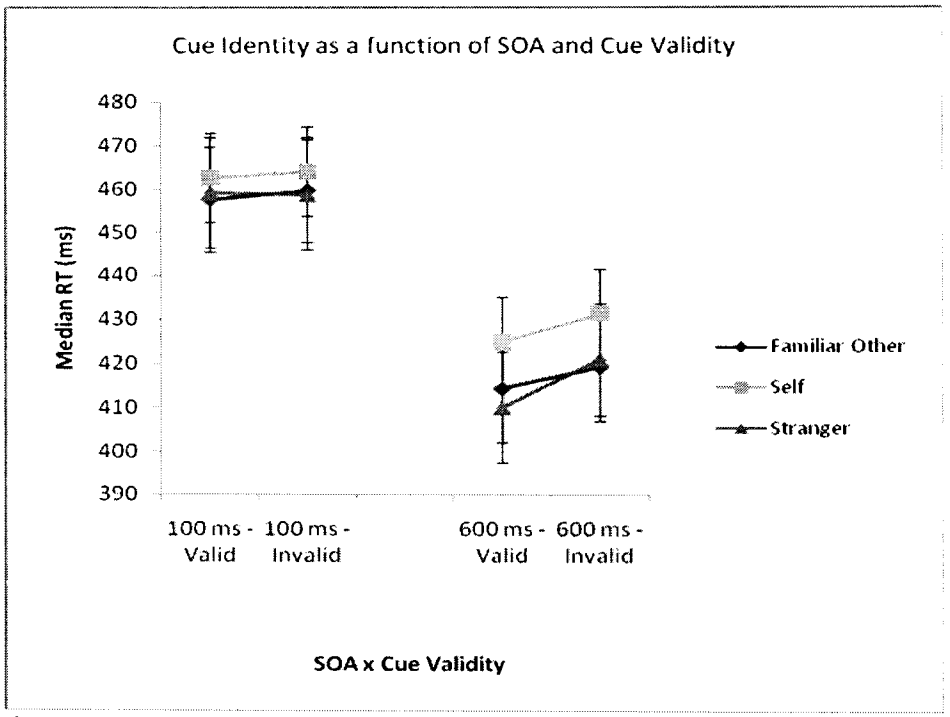


Figure 1. Means of the individual participants' median reaction times (in milliseconds) for the three cue providers identities as a function of SOA and validity.

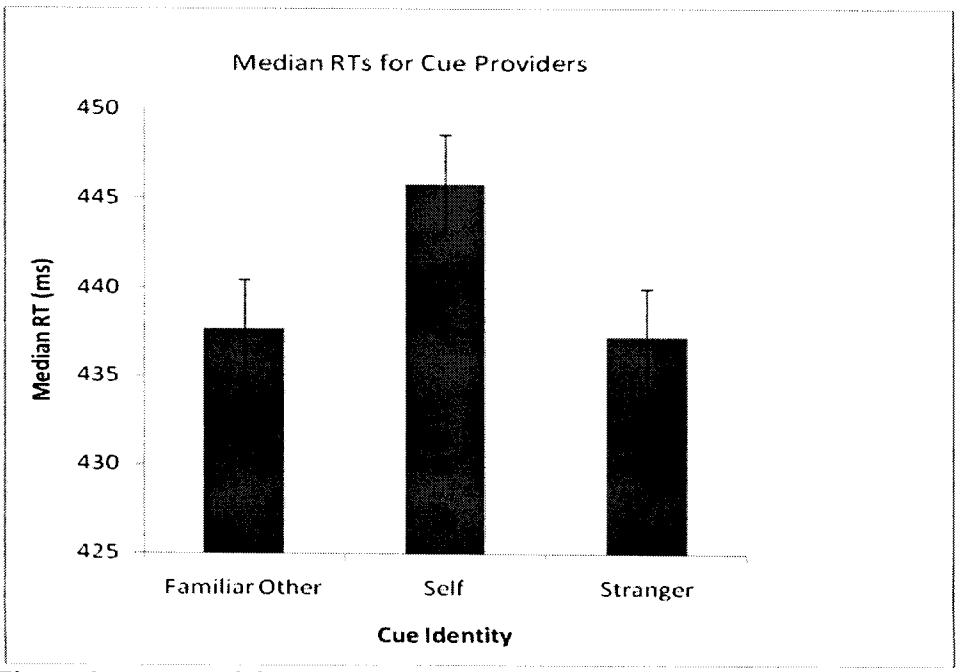


Figure 2. Means of the individual participants' median reaction times (in milliseconds) for the three cue provider identities.

Upon visual inspection of Figure 2, it appeared that the significant main effect for cue identity reflected a difference between the self and the other gaze cue providers. This was confirmed by *t*-tests which showed that the RT difference between familiar other and self was significant, $t(39) = 2.15$, $p < .05$ and the RT difference between stranger and self was significant, $t(39) = 2.27$, $p < .05$. Response times for stranger and familiar other were statistically equivalent ($p > .85$). Overall, participants responded significantly more slowly on trials in which their own face was presented than on trials in which another person's face was presented.

In addition to the three significant main effects, there was a significant cue validity by SOA interaction $F(1, 38) = 6.5$, $p < .01$. (See Figure 3).

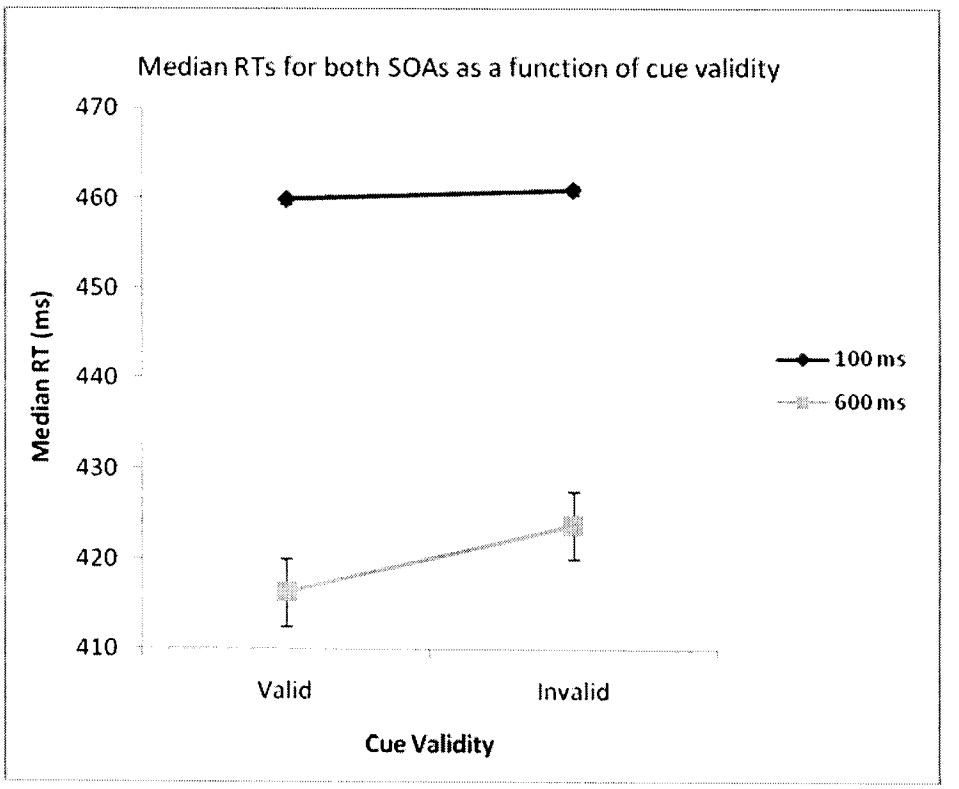


Figure 3. Means of the participants' median reaction times (in ms) for the 100 and 600 ms SOAs as a function of cue validity.

Follow up *t*-tests were conducted to examine this interaction. There was a significant difference between valid and invalid trials in the 600 ms condition $t(39) = 4.20$, $p < .0001$, but not in the 100 ms condition ($p > .50$). In other words, participants showed cuing effects at the 600 ms SOA but not the 100 ms SOA. No other interactions were significant (all $p$'s $> .10$).

Importantly, there was no significant interaction between cue identity and cue validity ($p > .50$), which was the main question of interest, nor was there a significant three-way interaction ($p > .50$). Although it was established that there were no significant interactions involving cue identity and validity at this juncture, cue identity was inspected further because of the cuing effects found at the 600 ms SOA. Further *t*-tests analyzing the cuing effect (invalid RT minus valid RT) at the 600 ms SOA confirmed that there were no significant differences in gaze cuing among the three cue providers (all $p$'s $> .25$).

Additional analyses inspected image orientation, gender, and cue order. Although these factors were not necessarily expected to produce significant effects, analyses were performed to check for unanticipated interactions. A within-subject analysis with image orientation (mirror, nonmirrored) added as a factor was conducted. No main effects or interactions involving image orientation were found (all $p$'s $> 1.0$).

In a between-subjects analysis, there was a significant main effect for gender, with males having faster overall RT than females, $F(1, 38) = 4.92$, $p < .05$). There was also a marginally significant cue identity x gender interaction $F(2, 38) = 2.50$, $p < .10$, and a marginally significant cue validity x gender interaction, $F(1, 38) = 2.86$, $p < .10$.

To explore the two marginally significant interactions, separate within-subject ANOVAs were run for females and males. For the females there was a significant main

effect for cue identity $F(1, 24) = 5.42, p < .02$. The same main effect was not observed for the males, $p > .40$. Post hoc comparisons for the females indicated that they responded more slowly to their own image than to either the image of their friend, $t(24) = 2.02, p < .05$, or the stranger, $t(24) = 3.26, p < .002$, and that RTs were equivalent for friend and stranger, $p > .20$. In other words, whereas males responded equivalently for all three cue providers, females were particularly slow on trials in which the cue was provided by their own face. For the females there was also a main strong effect for validity, $F(24) = 25.19, p < .0001$, and no validity x SOA interaction, $p > .25$. In contrast, for males there was no main effect for validity, $p > .30$, but there was a significant interaction between SOA and cue validity $F(1, 14) = 15.21, p < .005$. That is, whereas females showed orienting across the two SOAs, males oriented only at the 600 ms SOA, $t(14) = 3.83, p < .005$, and not at the 100 ms SOA, $p > .10$.

Further post hoc tests were conducted for each gender comparing valid and invalid RT at each SOA for each cue identity. For females, there was a significant gaze cuing effect in the 600 ms SOA self condition, $t(24) = 2.31$ $p < .03$, and in the 600 ms SOA stranger condition, $t(24) = 2.72, p < .001$ (all other $p's > .13$). For males, there was only a marginally significant cuing effect in the 600 ms SOA stranger condition, $t(14) = 1.90$ $p < .07$ (all other $p's > .13$).

A between-subject analysis was also conducted with cue order. Cue order by cue identity was marginally significant $F(2, 38) = 1.85, p < .07$. A visual inspection of the data revealed that for each of the six cue orders, participants were fastest to respond during the last block regardless of which cue it contained. Due to the nature of this interaction, it is likely that participants responded more quickly on trials in the last set of the experiment

because by then they had had more practice with the experimental task. Therefore, the cue order by cue identity interaction was not marginally significant in any meaningful manner.

Questionnaire Analyses

Because I was interested in findings involving cuing effects, all questionnaires were analyzed with only the 600 ms SOA data due to cuing effects demonstrated at the 600 ms SOA and not the 100 ms SOA. All personality measures were z-scored prior to the analysis (Robinson, 2007).

Friendship Quality Questionnaire (FQQ). The FQQ was used as a manipulation check to ensure the participants chose a partner who was indeed familiar to them. I also used this questionnaire to investigate whether participants who a reported higher level of familiarity with their friend might show greater gaze cuing effects when the cue provider was their close friend, compared with participants who reported a lower level of familiarity. A correlation analysis was run with the overall FQQ score for each individual and their overall cuing effect (collapsing across SOAs) for their friend's face. Some of the participants rated their partner as "not close", which posed a problem for analyzing the data. Subsequently, these individuals were taken out of the analysis. If the individual had an overall FQQ score of less than 3, they were excluded from the correlation analysis. Results with the remaining 25 participants indicated that the level of familiarity was positively correlated with the cuing effect for the friend ($r = .84$, $p < .05$). As predicted, the more familiar the friend was, the greater the gaze-cuing effect.

Autism Spectrum Quotient (AQ). A General Linear Model (GLM) was run using cue identity, cue validity, and autism spectrum scores. There were no main effects or interactions involving the autism spectrum scores (all $p$'s $> .10$).

Rosenberg Self-Esteem Scale. In a GLM analysis, self-esteem measures were entered as a continuous between-subject factor. Unlike Wilkowski et al. (2009), there was not a self-esteem by cue validity interaction ($p > .10$). There was, however, a marginally significant cue identity by self-esteem interaction, $F(2, 37) = 3.10, p >. 05$, which was in turn modulated by a marginally significant 3-way interaction for cue identity, cue validity, and self-esteem $F(2, 37) = 3.29, p = .05$. The analysis indicated a trend for individuals with low self-esteem to orient in response to the gaze direction of their friend, same-sex stranger, *and* their own face. On the other hand, people with high self-esteem oriented to the gaze cues of their friend and the stranger, but not to the gaze cues of their own face.

Interpersonal Dominance Scale. A GLM was performed to analyze cue identity, cue validity, and dominance scores. No main effect or interactions involving dominance scores were found (all $p$'s $> .10$).

# DISCUSSION

My hypotheses were partially supported. Faces of strangers have been used to elicit gaze-cuing responses from participants, and the strangers' faces have reliably produced orienting over many studies (for a review see Frischen & Tipper, 2007). Gaze cues provided by a familiar face have also been shown to produce orienting, and this orienting may be enhanced in some cases (Deaner, Shepherd, & Platt, 2007). In the present study, both the stranger faces and the familiar faces produced orienting as I had predicted (but only at the longer SOA). However, the familiar faces produced a cuing effect that was statistically equivalent to the cuing effect produced by strangers. Indeed, the cuing effect was significant across identities, indicating that participants also oriented in response to gaze direction cues provided by an image of their own face.

Deaner and colleagues (2007) found that females in particular responded more quickly to a gazed-at location when a familiar face provided the gaze cue. It is not known why females did not show enhanced orienting to their friend's face in the current study, but one possibility is that the "friend" they brought along for the study was not familiar enough to replicate the findings of Deaner et al. For this experiment, the participants were asked to bring in a close friend. Because I could not guarantee the closeness of the partners at the time of testing, the FQQ was implemented as a manipulation check. Unfortunately, a few of the partners did not rate each other as being "close". The lack of familiarity posed a problem for data analysis and for the overall purposes of the study. This will be addressed in the Limitations section.

Another consideration is that the faces in the Deaner et al. (2007) study were familiar in a different sense than the faces in the present study. In Deaner et al., the familiar

others were departmental figures with whom the students had come in contact at the university whereas the current study required that the participant bring a "close friend". Another difference is that Deaner and colleagues' study presented multiple instances of these casual acquaintances (6 male faces) whereas the current study presented the same "familiar other" face repeatedly. Additionally, the females in the Deaner et al. study saw only familiar male faces, whereas the females in the present study only saw familiar female faces. This will be discussed further in the Limitations section.

There was no specific prediction regarding a cuing effect for the self-face condition. It was thought that if gaze-triggered orienting is accomplished by a low-level mechanism, the self-face might produce a cuing effect that is equivalent in size to that produced by the familiar other's face. In this case, the expected cuing effects would be equal due to the familiarity of both faces. On the other hand, if gaze-triggered orienting is susceptible to semantic or top-down factors, the self-face would produce reduced orienting compared with the faces of others, or it might produce no orienting at all. This study demonstrated that individuals do, in fact, tend to orient to their own gaze cue. However, with the self-face, overall RT was significantly longer in comparison to the familiar other face and the stranger face.

Why might the self-face cause participants to respond more slowly? Devue and Bredart (2008) found that participants were slightly distracted by their own face, but eventually habituated to the image after multiple trials. Therefore, Devue and Bredart concluded that the self-face was not such a potent stimulus that it would continually distract the individual. In the present study, the self-face was presented repeatedly, giving participants the same opportunity to habituate to their own image. However, it appears that

participants *were* somewhat distracted or absorbed when attending to their own face, as demonstrated by slower reaction times in response to the peripheral targets. These results may suggest that looking at our own face for a gaze cue may be confusing. Or, perhaps individuals were not used to seeing their face presented on a computer screen, which may have instilled a sense of novelty and/or interest. Either possibility could have caused attention to remain on the self-face longer than it did with other people's faces.

I had expected to find that individuals who displayed autistic traits would be more likely to respond equally to all of the gaze cue providers. Research has demonstrated that individuals with autism are less sensitive to nonpredictive gaze cues (Ristic et al., 2005). Thus, it would be intuitive that participants scoring in the higher end of the normal range on autistic tendencies might show smaller gaze cuing effects than participants scoring in the lower end, and that their attentional responses to gaze cues might also be less sensitive to the identity of the gaze cue provider. However, these results were not observed. It is important to note that none of the participants in the current study scored on the clinical diagnosis spectrum of the AQ, although several individuals scored in the intermediate range. The AQ serves as an instrument which measures the degree to which an individual has traits associated with autism. Thus, a larger sample size with individuals who displayed greater levels of autistic traits would be preferable for a future study investigating this question.

I had originally predicted that individuals with low self-esteem would have greater cuing effects than individuals with high self-esteem, as found by Wilkowski et al. (2009). I was unable to replicate this finding. However, I did find a marginal interaction between self-esteem and cue identity. The data in the present study indicated that there was a trend

for individuals who scored low on the self-esteem measure to respond more quickly to targets preceded by their friend's face and by the stranger's face in comparison to individuals who had high self-esteem. The results of the self-esteem x cue identity interaction could be explained the sociometer theory (Leary, 1999), which suggests self-esteem regulates one's sensitivity to social cues. Individuals with low self-esteem may be more attuned to social stimuli such as other people's faces because they want to be included or feel like part of a group, and this might cause them to be more reactive to such stimuli.

I also found a marginal interaction between self-esteem, cue identity, and cue validity. There was a trend for individuals with low self-esteem to orient in response to the gaze direction of their own face as well as that of the other two faces, whereas people with high self-esteem oriented to the gaze direction of the other two faces but not to that of their own face. Under the sociometer theory, individuals with low self-esteem would be more likely to follow the lead of a close friend in order to maintain social inclusion and also would be more likely to track the gaze of a stranger if they were actively seeking a sense of belongingness in a group. This "social radar" is thought to play an important role in interpreting the actions of others in order to regulate one's own actions. The implications of my finding that participants with low self esteem oriented to their *own* gaze direction, however, are not readily apparent. One possibility is that such individuals are more generally socially reactive/receptive than individuals with high self-esteem. If this were the case they might be influenced by a broader class of social attentional cues than people with high self-esteem.

Limitations and Future Directions

One limitation of this study was the way in which familiarity was assessed. After further consideration of the familiarity measure used, it was possible that the FQQ was not an adequate or appropriate instrument for this experiment. In order to consider someone "familiar" for the purposes of this study, I wanted the friend to be someone who the participant saw on a regular basis and with whom the participant had established a fairly strong relationship or rapport. Some of the partners in the present study reported knowing each other for less than a year and did not consider themselves to be very close. Perhaps a better measure would have included an item asking how many times a day or week they saw that person's face. Additionally, a few of the participants rated their partner as not being close at all, which may have reduced my chances of observing an enhanced cuing effect for the "familiar other" cue provider. In addition, a few of the pairs were parent/child, teacher/student, or in some other type of relationship in which there may have been confounding variables, such as dominance/submission or a lack of personal rapport with the other person because of the circumstance of professional relationships.

Another possible confound could be the gender of the cue providers used in the present study. The gender of the stimulus face always matched the gender of the participant. Thus, a male always received a male self, stranger, and familiar other face, and a female received a female self, stranger, and familiar other face. This factor may have contributed to the unique results gathered in the present study. For example, females did not orient to their friend's face, but males did. Additionally, females oriented to their own face, while males did not. This result is somewhat surprising, as a past study demonstrated that females were more sensitive than males to gaze cues from familiar faces (Deaner et al.,

2007). However, as previously mentioned, the other study presented all male faces to both males and female participants. Thus, there may be a discrepancy between gaze-cuing to opposite sex and same-sex faces for females and males. In the future, it would be worthwhile to examine familiarity effects on gaze cuing with the gender of the stimulus faces and the gender of the participants fully crossed (although this is obviously impossible in the case of the self-face).

The last notable limitation is the small sample size. A larger sample size may be required to find significant interactions between cue provider identity and gaze-cuing effects, and to find significant correlations between individual differences and gaze-cuing effects. It is possible that more of the main effects or interactions that were predicted with autisitc tendencies and with self-esteem would have been significant. Moreover, the present data suggest the possibility of interesting gender differences. For example, my post hoc analyses of cuing effects for the different cue providers at the two SOAs indicated that females oriented to their own gaze direction but males did not. It will be interesting to see whether with more power the *gender x cue validity x cue identity* interaction will become significant. More subjects will be added to this study in the future to determine whether the marginally significant trends I have observed reflect the presence of reliable effects.

Once the effects of gaze cue provider identity on gaze-triggered orienting have been more clearly delineated, it will be interesting to examine them using event-related potentials (ERPs). Electrophysiological recording allows for a more fine-grained analysis of the timing of processing information about both the identity of a face and its gaze direction, and of the timing of the integration of the two as an attention shift is executed.

## Conclusions

To my knowledge, this was the first study that investigated the role of familiarity in gaze cuing by using the self-face as a cue provider. Overall, my hypotheses were partially supported. Two main points can be taken away from this study, one having to do with the attentional effects of viewing an image of one's own face, and the other having to do with self-esteem. First, individuals do appear to orient to gaze direction cues provided by an image of their own face, and they do appear to be distracted by their own image (i.e., their attention is held by their own face longer than it is held by other people's faces), despite claims by others that the self-face is not a distracting stimulus (Devue & Bredart, 2006). Second, the gaze and self-esteem findings from Wilkowski et al. (2009) were partially replicated. Although my results did not match perfectly, I did observe an interaction involving self-esteem, cue identity, and cue validity. These results provide further evidence that self-esteem plays a role in how individuals respond to gaze cues from other people. Also, individuals with low self-esteem tended to respond faster to targets preceded by images of friends and strangers in comparison to individuals with high self-esteem.

This study sets the stage for future research aimed at understanding the role of familiarity and individual differences in orienting to social signals. It is clear that not all individuals respond equally to different stimuli. By studying the relationship between social attention and individual differences, we can better understand how semantic and personal factors affect how people respond to socially-relevant events in our environment. Such research will contribute to the integration of knowledge in the more specialized fields concerned with visual attention, social psychology, and personality.

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# APPENDIX A. INFORMED CONSENT FOR PAY

**Title of Research Study: Gaze Cuing, Familiarity, and the Self**

**This study is being conducted by:**
Dr. Chris Kelland Friesen, Assistant Professor of Psychology at North Dakota State University, and Heather Wadeson, B.A., Graduate Student.

**Why am I being asked to take part in this research study?**
All participants must be 18 years of age or older; please inform the experimenter now if you are below the age of 18. Because you must be able to see the stimuli presented in the experiment, please inform the experimenter now if your corrected vision is poor.

**What is the reason for doing the study?**
Both social directional cues (such as the gaze direction of other people) and symbolic directional cues (such as road signs with arrows) are all around us in everyday life, and yet little is known to date about their attentional effects. We are interested in understanding the nature of the attentional orienting triggered by these directional cues. Until quite recently it was thought that there were only two types of orienting: automatic shifts of attention to the location of a sudden change in the environment, and deliberate shifts of attention to a location where an interesting event is expected to occur. Research has revealed that orienting to directional cues is a third kind of attentional orienting, one that is qualitatively different from the two previously-studied types. The present experiment is part of a larger project aimed at exploring the nature of this newly discovered type of orienting and understanding the environmental circumstances that influence it.

**What will I be asked to do?**
This study will be conducted in Minard Hall and will take approximately 60 minutes to complete. Your photograph will be taken for stimuli purposes only. Your photograph may also be used for other participants' stimuli.

1. You and your friend will have your photographs taken by an experimenter. You will also fill out a questionnaire addressing the quality of your friendship with that person.
2. You will be seated at a comfortable distance from a computer monitor, on which pictures of faces will be presented. You will be asked to respond to what was presented on the screen by pressing a computer button. There will be 24 practice trials and 576 experimental trials, for a total of 600 trials for you to perform.
3. After the experimental task, you will complete a series of surveys.
4. The last thing we will do is called 'debriefing' — this is basically a chance for us to talk a bit more about the study and for you to ask any questions you might have.

**What are the risks and discomforts?**
You may find that your eyes feel somewhat tired during the experiment. If this is the case, you should feel free to stop for a break at any time between blocks of trials, to rest your eyes, get a drink, etc. There are no known psychological, physical, economic, or sociological risks associated with the photograph being taken or with the administration of

the questionnaires. It is not possible to identify all potential risks in research procedures, but the researchers have taken reasonable safeguards to minimize any known risks to the participant. If new findings develop during the course of this research which may change your willingness to participate, we will tell you about these findings.

**What are the benefits to me?**
A potential benefit is that you will gain first-hand experience of being in a psychology laboratory experiment, and that after debriefing you will have learned something new about social attention and experimental design. However, you may not get any benefit from being in this research study.

**What are the benefits to other people?**
This research will help us learn how directional social cues cause us to shift our attention to an appropriate location in space, and how different variables in the environment influence this shifting of attention. Advances in our scientific understanding of human attention may one day lead to the development of therapies or treatments for attentional disorders.

**Do I have to take part in the study?**
Your participation in this research is your choice. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

**What are the alternatives to being in this research study?**
Instead of being in this research study, you can choose not to participate.

**Who will see the information that I give?**
We will keep private all research records that identify you. Your information will be combined with information from other people taking part in the study. When we write about the study, we will write about the combined information that we have gathered. You will not be identified in these written materials. We may publish the results of the study; however, we will keep your name and other identifying information private. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. For example, your name will be kept separate from your research records and these two things will be stored in different places under lock and key. Your photographs will be paired with a number, not with your name, and will be stored on a password-protected computer. Your photograph may be used in future studies.

**Can my taking part in the study end early?**
If you fail to show up to the session you may be removed from the study and will not be compensated the full amount, so it is important that you come to the scheduled session if you desire to complete the study.

**Will I receive any compensation for taking part in this study?**
You will receive $10 per hour for your participation. The experiment will take approximately 60 minutes, so you will receive approximately $10 or more if the experiment takes slightly longer.

**What if I have questions?**
Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, you can contact the researcher, Dr. Friesen at (701) 231-6311.

**What are my rights as a research participant?**
You have rights as a participant in research. If you have questions about your rights, or complaints about this research you may talk to the researcher or contact the NDSU Institutional Review Board (IRB) by

- Telephone: 701.231.8908
- Email: ndsu.irb@ndsu.edu
- Mail: NDSU Institutional Review Board, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050.

The role of the IRB is to see that your rights are protected in this research; more information about your rights can be found at: www.ndsu.edu/research/irb .

**Documentation of Informed Consent:**
You are freely making a decision whether to be in this research study. Signing this form means that

1. you have read and understood this consent form
2. you have had the consent form explained to you
3. you have had your questions answered, and
4. you have decided to be in the study.

You will be given a copy of this consent form to keep.

_____ _____
Your signature Date

_____
Your printed name

_____ _____
Signature of researcher explaining study Date

_____
Printed name of researcher explaining study

## APPENDIX B. INFORMED CONSENT FOR CREDIT

**Title of Research Study: Gaze Cuing, Familiarity, and the Self**

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Both social directional cues (such as the gaze direction of other people) and symbolic directional cues (such as road signs with arrows) are all around us in everyday life, and yet little is known to date about their attentional effects. We are interested in understanding the nature of the attentional orienting triggered by these directional cues. Until quite recently it was thought that there were only two types of orienting: automatic shifts of attention to the location of a sudden change in the environment, and deliberate shifts of attention to a location where an interesting event is expected to occur. Research has revealed that orienting to directional cues is a third kind of attentional orienting, one that is qualitatively different from the two previously-studied types. The present experiment is part of a larger project aimed at exploring the nature of this newly discovered type of orienting and understanding the environmental circumstances that influence it.

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3. After the experimental task, you will complete a series of surveys.
4. The last thing we will do is called 'debriefing' — this is basically a chance for us to talk a bit more about the study and for you to ask any questions you might have.

**What are the risks and discomforts?**
You may find that your eyes feel somewhat tired during the experiment. If this is the case, you should feel free to stop for a break at any time between blocks of trials, to rest your eyes, get a drink, etc. There are no known psychological, physical, economic, or

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A potential benefit is that you will gain first-hand experience of being in a psychology laboratory experiment, and that after debriefing you will have learned something new about social attention and experimental design. However, you may not get any benefit from being in this research study.

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**Do I have to take part in the study?**
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**What are the alternatives to being in this research study?**
Instead of being in this research study, you can choose not to participate.

**Who will see the information that I give?**
We will keep private all research records that identify you. Your information will be combined with information from other people taking part in the study. When we write about the study, we will write about the combined information that we have gathered. You will not be identified in these written materials. We may publish the results of the study; however, we will keep your name and other identifying information private. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. For example, your name will be kept separate from your research records and these two things will be stored in different places under lock and key. Your photographs will be paired with a number, not with your name, and will be stored on a password-protected computer. Your photograph may be used in future studies.

**Can my taking part in the study end early?**
If you fail to show up to the session you may be removed from the study and will not be compensated the full amount, so it is important that you come to the scheduled session if you desire to complete the study.

**Will I receive any compensation for taking part in this study?**
You will receive research credit (1 credit per 15 minutes) for your participation. The experiment will take approximately 60 minutes, so you will receive approximately 4 credits or more if the experiment takes slightly longer.

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1. you have read and understood this consent form
2. you have had the consent form explained to you
3. you have had your questions answered, and
4. you have decided to be in the study.

You will be given a copy of this consent form to keep.

_____ _____
Your signature Date

_____
Your printed name

_____ _____
Signature of researcher explaining study Date

_____
Printed name of researcher explaining study

# APPENDIX C. ETHNICITY SHEET

Which category best describes you? (Circle one)

- Caucasian/European
- African American
- Native Hawaiian or other Pacific Islander
- Hispanic/Latino
- Asian
- Native American/Alaska Native
- Other _____

# APPENDIX D. FRIENDSHIP QUALITY QUESTIONNAIRE

| | 1<br>Not at all true | 2<br>A little true | 3<br>Somewhat true | 4<br>Mostly true | 5<br>Really true |
|---|---|---|---|---|---|
| 1. _____ and I live really close to each other. | 1 | 2 | 3 | 4 | 5 |
| 2. _____ and I always sit together during social activities. | 1 | 2 | 3 | 4 | 5 |
| 3. _____ and I get mad at each other a lot. | 1 | 2 | 3 | 4 | 5 |
| 4. _____ tells me I'm good at things. | 1 | 2 | 3 | 4 | 5 |
| 5. If other people were talking behind my back, _____ would always stick up for me. | 1 | 2 | 3 | 4 | 5 |
| 6. _____ and I make each other feel important and special | 1 | 2 | 3 | 4 | 5 |
| 7. _____ and I always invite each other to social activities. | 1 | 2 | 3 | 4 | 5 |
| 8. _____ tells me I'm smart. | 1 | 2 | 3 | 4 | 5 |
| 9. _____ and I are always telling each other about our problems. | 1 | 2 | 3 | 4 | 5 |
| 10. _____ makes me feel good about my ideas. | 1 | 2 | 3 | 4 | 5 |
| 11. When I'm mad about something that happened to me, I can always talk to _____ about it. | 1 | 2 | 3 | 4 | 5 |
| 12. _____ and I argue a lot. | 1 | 2 | 3 | 4 | 5 |
| 13. When I'm having trouble figuring something out, I usually ask _____ for help and advice. | 1 | 2 | 3 | 4 | 5 |
| 14. _____ and I always make up easily when we have a fight. | 1 | 2 | 3 | 4 | 5 |
| 15. _____ and I fight. | 1 | 2 | 3 | 4 | 5 |
| 16. _____ and I loan each other things all the time. | 1 | 2 | 3 | 4 | 5 |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Not at all true | A little true | Somewhat true | Mostly true | Really true |

| | | | | | |
|---|---|---|---|---|---|
| 17. _____ often helps me with things so I can get done quicker. | 1 | 2 | 3 | 4 | 5 |
| 18. _____ and I always get over our arguments really quickly. | 1 | 2 | 3 | 4 | 5 |
| 19. _____ and I always count on each other for ideas on how to get things done. | 1 | 2 | 3 | 4 | 5 |
| 20. _____ doesn't listen to me. | 1 | 2 | 3 | 4 | 5 |
| 21. _____ and I tell each other private things a lot. | 1 | 2 | 3 | 4 | 5 |

22. On a scale from 1 to 5, how close are you and your friend?

1= not close at all
2= a little close
3= pretty close
4= very close
5= best friends

23. On a scale from 1 to 5, how much does your friend influence what you do (i.e., your activities, shows you watch)

1= not at all
2= a little
3= pretty much
4= very much
5= always

24. How long have you known your friend (in years or months)?

# APPENDIX E. AUTISM SPECTRUM QUOTIENT QUESTIONNAIRE

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Definitely Agree | Slightly Agree | Slightly Disagree | Definitely Disagree |

| | | | | |
|---|---|---|---|---|
| 1. I prefer to do things with others rather than on my own | 1 | 2 | 3 | 4 |
| 2. I prefer to do things the same way over and over again | 1 | 2 | 3 | 4 |
| 3. If I try to imagine something, I find it very easy to create a picture in my mind. | 1 | 2 | 3 | 4 |
| 4. I frequently get so strongly absorbed in one thing that I lose sight of other things. | 1 | 2 | 3 | 4 |
| 5. I often notice small sounds when others do not. | 1 | 2 | 3 | 4 |
| 6. I usually notice car number plates or similar strings of information. | 1 | 2 | 3 | 4 |
| 7. Other people frequently tell me that what I've said is impolite, even though I think it is polite. | 1 | 2 | 3 | 4 |
| 8. When I'm reading a story, I can easily imagine what characters might look like | 1 | 2 | 3 | 4 |
| 9. I am fascinated by dates. | 1 | 2 | 3 | 4 |
| 10. In a social group, I can easily keep track of several different people's conversations. | 1 | 2 | 3 | 4 |
| 11. I find social situations easy. | 1 | 2 | 3 | 4 |
| 12. I tend to notice details that others do not. | 1 | 2 | 3 | 4 |
| 13. I would rather go to a library than a party. | 1 | 2 | 3 | 4 |

| 1<br>Definitely Agree | 2<br>Slightly Agree | 3<br>Slightly Disagree | 4<br>Definitely Disagree |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 14. I find making up stories easy. | 1 | 2 | 3 | 4 |
| 15. I find myself drawn more strongly to people than things. | 1 | 2 | 3 | 4 |
| 16. I tend to have very strong interests, which I get upset about if I can't pursue. | 1 | 2 | 3 | 4 |
| 17. I enjoy social chit-chat. | 1 | 2 | 3 | 4 |
| 18. When I talk, it isn't always easy for others to get a word in edgeways. | 1 | 2 | 3 | 4 |
| 19. I am fascinated by numbers. | 1 | 2 | 3 | 4 |
| 20. When I'm reading a story, I find it difficult to work out the characters' intentions. | 1 | 2 | 3 | 4 |
| 21. I don't particularly enjoy reading fiction. | 1 | 2 | 3 | 4 |
| 22. I find it hard to make new friends. | 1 | 2 | 3 | 4 |
| 23. I notice patterns in things all the time. | 1 | 2 | 3 | 4 |
| 24. I would rather go to the theatre than a museum. | 1 | 2 | 3 | 4 |
| 25. It does not upset me if my daily routine is disturbed. | 1 | 2 | 3 | 4 |
| 26. I frequently find that I don't know how to keep a conversation going. | 1 | 2 | 3 | 4 |
| 27. I find it easy to "read between the lines" when someone is talking to me. | 1 | 2 | 3 | 4 |
| 28. I usually concentrate more on the whole picture, rather than the small details. | 1 | 2 | 3 | 4 |

| 1<br>Definitely Agree | 2<br>Slightly Agree | 3<br>Slightly Disagree | 4<br>Definitely Disagree |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 29. I am not very good at remembering phone numbers. | 1 | 2 | 3 | 4 |
| 30. I don't usually notice small changes in a situation, or a person's appearance. | 1 | 2 | 3 | 4 |
| 31. I know how to tell if someone listening to me is getting bored. | 1 | 2 | 3 | 4 |
| 32. I find it easy to do more than one thing at once. | 1 | 2 | 3 | 4 |
| 33. When I talk on the phone, I'm not sure when it's my turn to speak. | 1 | 2 | 3 | 4 |
| 34. I enjoy doing things spontaneously. | 1 | 2 | 3 | 4 |
| 35. I am often the last to understand the point of a joke. | 1 | 2 | 3 | 4 |
| 36. I find it easy to work out what someone is thinking or feeling just by looking at their face. | 1 | 2 | 3 | 4 |
| 37. If there is an interruption, I can switch back to what I was doing very quickly. | 1 | 2 | 3 | 4 |
| 38. I am good at social chit-chat. | 1 | 2 | 3 | 4 |
| 39. People often tell me that I keep going on and on about the same thing. | 1 | 2 | 3 | 4 |
| 40. When I was young, I used to enjoy playing games involving pretending with other children. | 1 | 2 | 3 | 4 |
| 41. I like to collect information about categories of things (e.g., types of car, types of bird, types of train, types of plant, etc.) | 1 | 2 | 3 | 4 |

| 1 Definitely Agree | 2 Slightly Agree | 3 Slightly Disagree | 4 Definitely Disagree |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 42. I find it difficult to imagine what it would be like to be someone else. | 1 | 2 | 3 | 4 |
| 43. I like to plan any activities I participate in carefully. | 1 | 2 | 3 | 4 |
| 44. I enjoy social occasions. | 1 | 2 | 3 | 4 |
| 45. I find it difficult to work out people's intentions. | 1 | 2 | 3 | 4 |
| 46. New situations make me anxious. | 1 | 2 | 3 | 4 |
| 47. I enjoy meeting new people. | 1 | 2 | 3 | 4 |
| 48. I am a good diplomat. | 1 | 2 | 3 | 4 |
| 49. I am not very good at remembering people's date of birth. | 1 | 2 | 3 | 4 |
| 50. I find it very easy to play games with children that involve pretending. | 1 | 2 | 3 | 4 |

# APPENDIX F. SELF ESTEEM SCALE

Please indicate the extent of your agreement or disagreement with each of the statements below, using the following scale:

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Strongly Disagree | Disagree | Agree | Strongly Agree |

_____ I feel that I am a person of worth, at least on an equal basis with others.

_____ I feel that I have a number of good qualities.

_____ All in all, I am inclined to feel that I am a failure.

_____ I am able to do things as well as most people.

_____ I feel that I do not have much to be proud of.

_____ I take a positive attitude toward myself.

_____ On the whole, I am satisfied with myself.

_____ I wish I could have more respect for myself.

_____ I certainly feel useless at times.

_____ At times I think I am no good at all.

# APPENDIX G. INTERPERSONAL DOMINANCE SCALE

Strongly Disagree ----------Strongly Agree
1 2 3 4 5 6 7

1. _____ I usually take charge of conversations.

2. _____ People usually turn to me when decisions have to be made.

3. _____I rarely influence others.

4. _____ I am often responsible for keeping conversations going when I talk with others.

5. _____ I usually do more talking than listening.

6. _____ I have very little skill in managing conversations.

7. _____ I never find out what others think before taking a stand on an issue.

8. _____ I often stop to think about what to say in conversations.

9. _____ It seems as though I find it hard to keep my mind on the conversation.

10. _____ I am often influenced by others.

11. _____ I often insist on discussing something even when others do not want to.

12. _____ I often make my presence felt

13. _____ I often win any argument that occurs in conversations.

Strongly Disagree ----------Strongly Agree
1 2 3 4 5 6 7

14. _____ I am self-confident when interacting with others.

15. _____ I am nervous in conversations with others.

16. _____ I am concerned with other's impressions of me.

17. _____ I have a natural talent for winning over others.

18. _____ I have trouble concentration on the topic of conversation.

19. _____ I am very expressive during conversations.

20. _____ I am often the center of attention.

21. _____ I have a dramatic way of interacting.

22. _____ I am usually relaxed and at ease during conversation.

23. _____ I often avoid saying things in conversation because I might regret it later.

24. _____ I am more of a follower than a leader.

25. _____ I often have trouble thinking of things to talk about.

26. _____I have a way of interacting that draws people to me.

27. _____I remain task-oriented during conversations.

Strongly Disagree ----------Strongly Agree
1 2 3 4 5 6 7

28. _____ I show a lot of poise during interactions.

29. _____ I am not very smooth verbally.

30. _____I often act impatient during conversation.

31. _____ I am usually successful in persuading others to act.

32. _____ I have a memorable way of interacting.

# APPENDIX H. EXPERIMENTER INSTRUCTIONS

**Please turn your cell phone OFF or on silent. Do not put it on vibrate.**

This experiment will consist of 3 sets. For one set you will see your own face, in another block you will only see your friend's face, and in a third block you will see a stranger's face. You will then be asked to fill out a series of questionnaires after the experimental trials.

**SEQUENCE OF EVENTS ON EACH TRIAL:**

- Before each set you will complete a series of practice trials.
- First, a fixation cross will appear in the center of the screen for a brief amount of time.
- Next, a face will appear with the eyes looking to either the left or right.
- Finally, a target will appear on the left or right side of the screen. The target will either be an "X" or a "O". When the "X" appears on either side, press the button as indicated by the experimenter. When the "O" appears on either side, press the button as indicated by the experimenter.
- After completing 3 sets of 64 trials for each identity set (or a total of 576 experimental trials), you will be asked to fill out a series of questionnaires. You will respond to these questionnaires by responding on the keyboard.

**YOUR TASK:**

- Please fixate your eyes on the fixation cross at the center of the screen between trials. During the trials, focus on the nose of the face. Try to keep your eyes fixated at that location throughout the experimental trials.
- Each time the target appears to the left or right of the face; your task is to make a keypress as quickly as possible.

**ORDER OF EVENTS:**

In total, there will be 24 practice trials and 576 test trials (3 blocks of 64 trials for each cue identity) for a total of 600 test trials.

Throughout the experiment, a message will appear on the screen telling you which block is coming up next. Please take a minute or two between blocks to rest your eyes, and then press the button box to begin the next block when you are ready.

The entire experimental session should take about 60 minutes.

**IMPORTANT INFORMATION:**

Whether the eyes of the face look to the left or to the right does not predict in any way where the target circle will appear. In other words, THE DIRECTION OF THE GAZE CUE (LEFT OR RIGHT) AND THE LOCATION OF THE TARGET (LEFT OR RIGHT) ARE BOTH COMPLETELY RANDOM.

DO NOT MOVE YOUR EYES from the center of the fixation display during the experimental trials.

If you need to blink, please try to do so between trials.

Do you have any questions?

# APPENDIX I. DEBRIEFING FORM

In the present experiment, you were asked to fixate on the center of a display with a picture of a face (self, stranger, or friend) flanked by X's or O's on the left and right. Which way the eyes looked was not in any way predictive of where the target would appear. Your task was to keep your eyes fixated on the center of the screen and to make a keypress as quickly as possible in response to the appearance of the target.

Previous research has shown that when the cue does not predict where a target will appear, people are faster to make a response to a target appearing at a validly cued location (i.e., the target appears where the eyes looked) than to a target appearing at an invalidly cued location (i.e., the target appears on the side opposite to where the eyes looked) (e.g., Friesen & Kingstone, 1998; ; Posner, Cohen, & Rafal, 1982; Ristic, Friesen, & Kingstone, 2002). From the response time differences between valid and invalid trials, we are able to infer that people are shifting their attention quickly and automatically to where the eyes are looking. The experiment in which you have participated is part of a larger study examining the perceptual components of gaze direction processing.

The findings from this study will add to our knowledge of how people respond attentionally to biologically relevant directional cues (eye gaze cues) and of how these attentional effects interact with perceptual processing and with the motor response systems for manual responses and eye movements. Thus, they will also contribute to more general theories concerning what types of stimuli cause us to shift our visual attention from one location in space to another and how these attention shifts affect people's behavior. Additionally, this research may form the basis for future studies aimed at investigating what areas of the brain are responsible for processing attentional cues and how these brain areas develop during childhood.

Thank you very much for your time; your participation is greatly appreciated! If you have any further questions about this research, please feel free to contact Dr. Friesen by phone at 231-6311, or by email at: chris.friesen@ndsu.edu.