Exploring Adolescents' Social Validity Ratings of Social Profiles: The Impact of Eye Contact

by

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Abstract

Attending to the eyes of another person has an adaptive function demonstrated within the first few months of human life. Non-verbal transactions in the form of eye contact facilitate both cognitive and social development; however, individuals with autism spectrum disorder and other neurodevelopmental disorders often display little or no eye contact during social exchanges. Deficits like these can lead to detrimental effects as individuals expand their social networks, especially in adolescence; however, little is known about how others perceive individuals with this deficit. Nuhu and Rapp (2020) identified three profiles during interviews with college students characterized by varying levels of eye contact, vocalizations, and body movement. They found participants typically emitted high levels of eye contact (i.e., above 80%) during social interactions. Subsequently, Bush et al. (2022) recreated the three social profiles with an actor and evaluated college students' ratings of the actor in each profile. Their results indicated profiles with higher levels of eye contact received more favorable ratings than the lower eye contact profile. The current study replicated and extended their research by presenting the same profiles and assessments to two groups of adolescents, those from an urban high school (i.e., non-justice-involved youth) and those from a secure juvenile-justice facility (i.e., justice-involved youth). Findings indicate adolescents can distinguish variations in eye contact and judge speakers differently based on their perceptions. Implications and next steps are discussed.

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

ANOVA	Analysis of Variance
ASD	Autism Spectrum Disorder
CBOS	Communicative Behavior Observatory Scale
CBT	Cognitive Behavioral Therapy
CU	Callous-Unemotional
DTI	Discrete Trial Instruction
ICU	Inventory for Callous-Unemotional Traits
IGP	Interpersonal Gaze Processing
NCES	National Center of Education Statistics
PEERS®	Program for the Education and Enrichment of Relational Skills
RTN	Response to Name
SAD	Social Anxiety Disorder
TASSK	Test of Adolescent Social Skills Knowledge

Introduction

The human eye plays an intricate and important role in human interactions. Through eye gaze, humans can both give and receive vital information. Humans are the only species to have a large portion of white sclera around a smaller dark iris which reflects the eyes distinguishable form of communication (Emery, 2000; Kobayashi & Kohshima, 1997). This feature gives eye gaze and eye contact, used interchangeably throughout this paper, adaptive significance (e.g., signal threat; Senju & Johnson, 2009b). Evolutionary psychologists suggested the human brain contained a module specifically for processing eye gaze called the 'eye direction detector' (Emery, 2000; Farroni et al., 2003). However, neuroscientists have since refined this idea, suggesting eye gaze is embedded in functions of a general face processing system, not modulated by one isolated structure (Babinet et al., 2021; Hoehl et al., 2009). The neurological underpinnings of eye contact may serve as the foundation for successful social interactions. To this end, researchers have discovered the necessity of eye gaze for areas such as infant-caregiver attachment (e.g., Robson, 1967), language acquisition (e.g., Blake et al., 1992), development of empathic behavior (e.g., Dadds et al., 2012, 2014; Waller & Hyde, 2018), emotion recognition and processing (e.g., MacLean et al., 2014), and navigating complex social interactions (e.g., Canigueral & Hamilton, 2019; Cortez et al., 2017).

As noted above, researchers have demonstrated the importance of eye gaze in cognitive development and human social interactions; however, normal eye gaze behavior remains poorly understood. 'Normal' characterizes the level of eye gaze behavior facilitated by humans during successful[1] social interactions. A 'normal' level of eye gaze can also be conceptualized as the amount of eye contact that receives socially mediated reinforcement (e.g., reciprocation of a

[1] Although this is neither clearly nor consistently defined in the literature, one can assume that it indicates the referent individual contacts one or more sources of reinforcement (and avoids aversive events).

conversation). In this regard, the perception of others might determine the level of eye gaze reinforced within a given culture. However, the literature contains limited research on the evaluation of how individuals perceive others' who emit differing levels of eye contact. Through observations of individuals exhibiting eye contact in different contexts and the evaluation of individuals' perception of eye gaze, researchers may be able to establish normative levels that could inform the development of both training programs and outcome criteria. Clinicians could then appropriately train to the level that would contact reinforcement in the individual's natural environment. Importantly, failure to engage in eye gaze could lead to the underdevelopment of vital skills, poor social interactions, and possibly social exclusion.

Given the limited understanding of eye contact, coupled with its biological and social significance, researchers should seek to discover 'normative' levels of eye contact. The current review covers a range of topics, some of which are primarily theoretical in nature, to elucidate the importance and relevance of eye gaze for many behaviors across many populations. The review begins with a general overview of neuronal responses to perceived eye gaze. In part, the review briefly discusses the relevance of eye gaze in the development of prosocial behaviors and its role in complex social interactions. Thereafter, the review highlights populations impacted by deficits in eye contact. Lastly, the paper concludes with (a) a critical review of behavioral interventions and outcome criteria used to address eye gaze deficits, and (b) a proposal to evaluate adolescents' perceptions of individuals with varying levels of eye contact.

Eye Contact and Neuronal Responses

Neuroimaging studies with individuals from early infancy (as young as 4 months of age) to young adults (mid-twenties) indicate an individual's perceived eye contact modulates the activation of the 'social brain' network (Babinet et al., 2021; Grossman, 2015; Senju & Johnson,

2009a & b). Researchers describe the activation of the 'social brain' as 'the eye contact effect' because it is eye contact with another individual that activates this specific neuronal activity (Senju & Johnson, 2009b). The social brain network includes the fusiform gyrus, superior temporal sulcus, medial prefrontal and orbitofrontal cortex, and amygdala (Senju & Johnson, 2009a & b; Stuart et al., 2022), with the eye contact effect originating in the medial prefrontal cortex (Wang et al., 2011). Researchers have suggested the amygdala has a core role in humans' preference for direct eye gaze and fixation (Adolphs et al., 2005; Senju & Johnson, 2009b; Spezio et al., 2007).

The face is a visual stimulus that conveys important information (Babinet et al., 2021). Researchers have theorized that the amygdala encodes face-related information early after the onset of facial stimuli (e.g., Falck-Ytter et al., 2015; Krolak-Salmon et al., 2004; Senju & Johnson, 2009a). At least one study has found mutual eye contact evokes a response as rapidly as 85 ms with individuals exhibiting emotion recognition at around 115 ms (Hadjkhani et al., 2017). Other studies have discovered this effect occurs even without the physical presence of another human (e.g., video call; Hietanen et al., 2020), if the interaction is live (i.e., not a recording; Noah et al., 2020). Researchers have also detected heart rate changes (i.e., either increases or decreases) for some individuals when they engage in direct gaze (Akechi et al., 2013). The 'social brain' can also distinguish face-to-face human interaction. For example, Kiilavuori et al. (2021) found similar neuronal responses to direct and averted gaze when humans interacted with other humans as well as with robots. However, human-to-human eye gaze reliably evoked stronger activation. Although researchers have yet to develop a complete understanding of how the brain processes and utilizes eye contact, they have provided ample evidence that it performs a significant role, especially in social contexts.

Eye Contact: A Component of Social Interactions

Social interaction is the process by which two or more people act and react to each other during social encounters. One component of social interactions is the perception of eye contact. Palmer et al. (2022) discovered the 'zone of eye contact', which allows individuals to perceive or detect that another person is making eye contact. Perceived eye gaze sends a signal to another individual that they can automatically identify, and gaze perception is the ability of that individual to discriminate others' directed gazes (Lasagna et al., 2020). Interestingly, Palmer et al. found the most common facial region individuals perceive as direct gaze (from another person) is between the eyes. Therefore, increasing eye contact may be possible by increasing levels of direct *perceived* gaze (Rogers et al., 2019). The ability to detect perceived gaze is imperative because it may indicate the individual is approachable (i.e., socially mediated reinforcement is available), whereas gaze diversion might signal avoidance (i.e., socially mediated reinforcement is not available).

In addition to signaling that socially mediated reinforcement is available, individuals may experience a perceived feeling of closeness to others with whom they make eye contact. Cui et al. (2019) investigated the extent to which eye contact communicates closeness in the relationship between two familiar or unfamiliar individuals. Cui et al. evaluated direct gaze through two experiments where they measured reaction time when they paired direct and averted gaze with words or pictures representing either distance or closeness in relationships (i.e., implicit association task). Individuals responded faster when presented with direct gaze paired with a close-relationship stimulus (i.e., word or picture). Cui et al. theorized direct gaze with a familiar person might enhance the individuals' feelings of social support. On a descriptive level, the process sounds like stimulus equivalence, where the presented stimuli represented a symbolic

relationship (e.g., Sidman, 1997, 2009). Interpretation notwithstanding, eye gaze appears to be a critical behavioral feature in initiating social exchanges.

As another important component of social interactions, direct eye gaze affects an individual's ability to mimic. (Wang et al., 2011). Researchers have defined mimicry as the spontaneous copying of others' behavior (Chartrand & van Baaren, 2009; de Klerk et al., 2018). de Klerk et al. (2018) found infants only showed mimicry when they viewed facial movements accompanied by direct gaze, suggesting that this simple behavior plays an important role in social interactions from early infancy. This may be one of the reasons researchers have found that only days after birth infants prefer direct gaze (e.g., de Klerk et al., 2018; Farroni et al., 2003, 2007; Robson, 1967). Like mimicry, imitation is the copying of another individual's behavior, but imitation is the reproduction of specific actions demonstrated by a model (Vivanti et al., 2008). The first step to imitation is observing the model. Then when the observer engages in the modeled responses, reinforcement occurs for the correspondence between the observation and produced action, which could lead to more imitation in the future. Although it may seem as though the individual would need more focus on the modeled behavior, the findings from Vivanti et al. suggest eye gaze might be an important element of imitation. They studied imitation differences in individuals diagnosed with autism spectrum disorder (ASD) and typically developed individuals and found that those with ASD gave the same amount of attention to the presented action as the typically developed individuals; however, consistent differences emerged in the overall patterns of gaze to the model's face. Their results suggest that eye gaze is important for the skill of imitation.

Eye contact is also imperative for acquiring additional skills other than mimicry and imitation. For example, Silva and Fiske (2021) evaluated the impact of requiring eye contact

before each trial during discrete trial instruction (DTI) for three children diagnosed with ASD. They manipulated eye contact as a treatment integrity error to create two conditions, high integrity (i.e., 100% of trials required eye contact) and low integrity (i.e., 33% of the trials required eye contact). Skill acquisition occurred for all three children in fewer trials during the high integrity condition. Their findings imply engagement in eye contact resulted in faster skill acquisition.

The previously mentioned research suggests eye gaze plays a considerable role in receiving and giving social reinforcement through eye gaze perception and perceived closeness. Likewise, eye contact within mimicry, imitation, and skill acquisition training increase social and adaptive skills. However, social interactions are even more complex than these singular components, especially the social interaction of conversations. Researchers from a variety of disciplines have analyzed the components that comprise these complex social interactions for decades.

In a seminal paper, Kendon (1967) theorized eye gaze served regulatory, monitoring, and expressive functions in conversations. Eye gaze likely acquires these functions during the development of listener and speaker skills in early language acquisition. The regulatory function allows an individual to modulate transitions between being the listener and the speaker. For example, an individual in a conversation might indicate turn-taking by shifts in eye gaze when the listener may be ready to speak, as well as when the speaker is finishing a point (Canigueral & Hamilton, 2019). The listener and speaker reinforce these shifts in gaze when they give each other the opportunity to take a turn. The monitoring function allows individuals to track the attention of others and perceive and convey facial displays that improve mutual understanding and social approval during verbal episodes. In other words, facial stimuli become paired with

specific emotions and reactions that eye gaze allows the observer to tact and then give a variety of responses so that the listener's and speaker's interlocking contingencies continue. Lastly, the expressive function of eye gaze allows the individual to regulate the level of arousal; all of this purportedly happens through the temporal coordination of gaze patterns. Different arousal levels become paired with differing amounts of eye gaze, and an individual can engage in the level of eye gaze needed to increase or decrease arousal depending on the context of the situation and conversation.

Communicative exchanges are complex insofar as individuals need to be able to make constant adjustments in eye gaze to keep pace with the interpersonal dynamics that emerge in a conversation. In a combination review article and position piece, Canigueral and Hamilton (2019) proposed the interpersonal gaze processing (IGP) model, which incorporates the ideas of Kendon (1967). The IGP model considers how eye movements transition in social contexts and proposes gaze control systems in the brain must evaluate the incoming information and signal potential, to determine where to look next in social interactions. For instance, a look away from eye contact might serve as a discriminative stimulus for the other individual to take the turn of speaker and direct gaze with other facial stimuli may serve as a mand that the listener would like to take a turn speaking. A significant portion of the signaling happens with the eyes, and individuals continuously exchange information through these social signals (Canigueral & Hamilton, 2019). All the nuances of a conversation employ eye gaze to produce social signals that reinforce both the speaker and the listener, leading to more social interactions within and across relationships.

Much of the research discussed up to this point posits conceptual frameworks for understanding the role of eye gaze in social interactions. However, there are many types of

successful interactions that researchers can evaluate through applied studies. An example of a necessary successful social interaction is the ability to attain and retain meaningful and paid employment. Cortez et al. (2017) explored the impact of body language (e.g., gestures, personal distance, etc.) and facial expressions on employers' perceptions of applicants. They found employers sought smiling and eye contact as the two most important facial behaviors. Most employers stated they looked for “good” eye contact and all the employers agreed on the crucial aspect of eye contact in an interview. Notably, employers looked for eye contact within the first 10 s of meeting a new applicant. Also, the few applicants Cortez et al. surveyed identified the importance of eye contact when interviewing. Employers expressed cultural sensitivity when interviewing applicants from cultures where eye contact may have a different value. Overall, the findings from Cortez et al. support the importance of sufficient eye contact during interviews. Unfortunately, they did not specify the amount of eye contact in objective measures.

Additionally, the way in which others perceive an individual's character is important in complex social interactions, especially when developing business and personal relationships, testifying in court, or in the context of displaying remorse when accused or convicted of a crime. Impairments in eye gaze might have a negative impact. Lim et al. (2022) examined the role of eye gaze, along with four other predictor variables, on the perceived deception and credibility of individuals diagnosed with ASD as compared to neurotypical individuals. The researchers used video-recorded interviews followed by questions for the participants to rate. Overall, they rated individuals with ASD higher on perceived deception and lower on perceived competence and character. Researchers did not find one isolated behavior as the main predictor of either deception or credibility, but rather the collective whole of behaviors. Although researchers did not find eye gaze differences between groups, participants cited gaze aversion as the most

common cue used to determine the truthfulness and credibility of the interviewee when asked qualitative questions about their ratings; further suggesting the importance of others' perception of eye gaze. In all, eye gaze is a central component of initiation, reciprocation, and prolongation of social interactions.

Prosocial Behaviors Attributed to Eye Contact

Eye contact is not only essential for the components of successful social interactions, but researchers have also found eye gaze to be crucial in the development of several prosocial behaviors (e.g., Bedford et al., 2015; MacLean et al., 2014; Senju & Johnson, 2009b). Specifically, understanding the role of eye gaze in the development of empathy, emotion regulation, social cognition, and shared or joint attention may refine intervention efforts. Deficits in the development of these behaviors may contribute to negative life outcomes (e.g., social isolation, delinquency, social anxiety, etc.).

Researchers have characterized empathy, an affective state that mirrors the state of others and induces physiological symmetry, as a core feature of successful social interactions (Cowan et al., 2014; Decety & Jackson, 2004; Singer, 2006). A model proposed by Zaki and Ochsner (2012) suggested empathic behavior comprises three major components: (a) experience sharing, (b) perspective-taking, and (c) prosocial concern. Researchers have established eye contact or eye gaze as essential for the development of each component (Cowen et al., 2014; Dadds et al., 2012, 2014; Emery, 2000; Gehrer et al., 2021; Itier & Batty, 2009).

Without the development of empathy, a child may develop callous-unemotional (CU) traits. High CU traits are a defining feature of psychopathy in youth (Allen et al., 2018). Studies have found individuals with high levels of CU traits demonstrate problems with affective empathy, reactive or predatory aggression, are under-emotional, and exhibit behaviors such as

bullying and delinquency. Impairments in attention to the face, specifically eye contact, may result in empathy deficits (Dadds et al., 2012; Gehrer et al., 2020, 2021; Waller & Hyde, 2018). Dadds et al. (2012)[2] used a series of assessments to evaluate the relation between eye contact and CU traits for 24 children, ages 4 to 8 years old. In part, Dadd et al. (2012) assessed initiated and rejected eye contact between the child and parents. To replicate their study with a larger sample, Dadds et al. (2014) used the same questionnaires, assessments, and eye contact measures for 75 additional participants of the same age range. Both studies found a high correlation between eye contact and the level of CU traits. Specifically, individuals with high levels of CU traits consistently exhibited deficits in eye contact.

Subsequently, Cowan et al. (2014) used an Eyelink SR1000 eye-tracking device and the Interpersonal Reactivity Inventory assessment to measure levels of eye contact in relation to empathy for 59 participants recruited via Facebook™ from a metropolitan area. Cowan et al. found individuals lower in emotional and cognitive trait empathy had shorter dwell times to the eye region with irregular gaze patterns (e.g., attending to less relevant facial stimuli) when presented with videos of individuals talking to the screen (i.e., eye contact). Moreover, their results confirmed that trait emotional empathy was the variable underlying the observed dwell time effect (i.e., longer dwell times for individuals higher in trait empathy). The results from Cowen et al. suggest low eye contact is a feature of low empathy, which could ultimately lead to CU trait development.

Equally important to the development of empathy, individuals must learn how to detect others' emotions. Emotion recognition is a conditional discrimination that evokes a different

[2] This study included the following assessments: Strengths and Difficulties Questionnaire, Antisocial Process Screening Device, Parents Feelings Questionnaire, Childhood Asperger's Syndrome Test, Alabama Parent Questionnaire, Psychopathic Personality Inventory.

behavior from the observer (Sosnowski et al., 2022). Researchers suggest the ability to recognize others' emotions is a building block of more complex emotional and social understanding (Jones et al., 2011). Baron-Cohen et al. (1997) suggested eye gaze allows the observer to detect facial stimuli representing the complex mental states of others such as revenge and regret; they provided preliminary support of their hypotheses through a series of experiments. They used the first two experiments to validate their hypothesis and a third to evaluate individuals' ability to recognize complex mental states when diagnosed with ASD, given the results of the previous experiments. Baron-Cohen et al. showed 67 participants various pictures with only eyes, only mouth, or the whole face of a person. Results indicated the pictures of eyes alone conveyed enough relevant stimuli to facilitate the discrimination of complex mental states as easily as when viewing the whole face. These findings suggest increasing attention to the eyes of a person could increase their ability to correctly tact others' emotions. In the third experiment, Baron-Cohen et al. assessed the ability of 16 individuals with ASD, compared to a control group of 16 individuals without a diagnosis, to discern complex mental states using either the eyes only or the whole face. The results revealed significantly worse performance from those in the ASD group than the control group for both conditions, with even greater differences in the eyes-only condition. Their findings further support eye gaze as a fundamental component in the ability to recognize complex mental states, especially when only given the visibility of eyes.

Most recently, Sosnowski et al. (2022) evaluated the extent to which a video game intervention using audio and visual prompts during shaping increased eye and mouth gaze for 54 children with ASD. In part, Sosnowski et al. evaluated changes in participants' emotion recognition following the intervention, which they assessed using Ekman-60 (i.e., presentation of 60 faces across 10 actors presenting six basic emotions). Results indicated a significant increase

in accurate responding after the intervention, with a large effect size. These results further support the role of eye gaze in emotion recognition.

In addition to emotion recognition, perceiving and self-managing one's own emotions (i.e., emotion regulation) is a crucial skill for social interactions. Researchers define emotion regulation as the automatic or intentional modification of one's emotions that promotes adaptive behavior (Mazefsky et al., 2013; Thompson, 1994). Researchers speculate emotion regulation starts developing in early infancy; mutual eye gaze between a caregiver and young infant aids in developing this essential skill (MacLean et al., 2014). Although emotion regulation begins in infancy, the areas of the brain involved in emotion regulation (i.e., amygdala, ventral striatum, and structures of the ventral prefrontal cortex; Monk, 2008) undergo considerable growth during the adolescent years (Steinberg, 2005). Behaviorally, specific internal events (i.e., emotions) pair with specific facial and contextual stimuli during early childhood. Accordingly, children may learn behaviors to relieve aversive emotions or reduce high levels of emotion through modeling and verbal language. Subsequently, these behaviors become reinforced through various social sources as the social network of an individual increase during adolescence. By contrast, limited emotion regulation can lead to depression, anxiety, and antisocial behavior (Ahmed et al., 2015).

Social cognition is an additional construct that involves eye contact. Researchers explain social cognition as the ability of an individual to use information in social contexts and predict their own and others' behavior (Beer & Ochsner, 2006). Researchers hypothesize that eye contact directly activates social cognition through its ability to induce the intention to communicate (e.g., Babinet et al., 2021; Kampe et al., 2003).

Lastly, joint attention or gaze-following is a foundational skill for the development of more complex social behaviors and skill acquisition. Researchers define joint attention as the

coordination of two or more individuals' attention for the purpose of sharing information (e.g., Caruana et al., 2020). Dube et al. (2004) explained joint attention as behavior in response to an environmental event or stimulus in which the individual uses gaze shift (sometimes coupled with gestures) to mand for the observer's gaze to also shift toward the event or stimulus; the mand is then reinforced through the observer's gaze shift along with socially mediated or generalized reinforcers. The early development of joint attention occurs between the ages of 9 and 12 months and one of the first topographies is shifts in gaze between an individual and an object (Dube et al., 2004). Interestingly, Senju and Csibra (2008) discovered that 6-month-old infants followed another person's gaze shift only when preceded by direct gaze or other communication cues. Some may not develop this skill until early childhood, but this finding suggests joint attention begins developing in early infancy (Gunby et al., 2017; Shepard, 2010).

Joint attention is especially important for children, considering some skill acquisition may rely on joint attention such as the association of nouns when teaching language and the development of complex social skills (Frischen et al., 2007; Gliga et al., 2012; Gunby et al., 2017). Given the importance of joint attention, individuals with impaired eye gaze may experience deficits in learning and social skills. Furthermore, as individuals mature into adults, joint attention might allow for the understanding and prediction of others' actions, which can increase their ability to engage in complex social situations such as engaging with a potential romantic partner (Frischen et al., 2007; Wohltjen & Wheatley, 2021). Overall, researchers have established eye contact as a necessary component for foundational social skills, acquisition of complex social skills, and the development of prosocial behaviors.

Populations Impacted by Eye Gaze

Eye contact, as a communicative behavior, impacts various populations and their social interactions. Individuals exhibiting lower eye contact or eye gaze may experience social exclusion, which can contribute to comorbidities such as depression and anxiety (Mason et al., 2012). For some disorders, low eye contact is a defining feature (e.g., ASD or Fragile X syndrome) whereas for others low eye contact is a behavioral side effect (e.g., individuals with either SAD or Conduct Disorder). Although impacted populations may differ in diagnoses or situations, research indicates reduced eye contact is associated with negative outcomes.

Individuals diagnosed with social anxiety disorder (SAD) may experience eye gaze deficits. Eye-tracking studies have confirmed individuals with SAD have a lower gaze fixation time when presented with faces (Chen et al., 2021; Horley et al., 2003, 2004; Moukheiber et al., 2010). According to Schneier et al. (2011), this lower gaze fixation may cause less eye contact during social interactions and could lead to a decrease in attending to important social information (i.e., relevant stimuli) when developing and maintaining relationships. Individuals with SAD have reported gaze aversion as a response to the fear and anxiety that come from social situations. When gaze aversion terminates or reduces negative feelings, it may become negatively reinforced thereby maintaining gaze aversion and leading to diminished positive social interactions. In turn, others may interpret gaze avoidance as disinterest, and further reduce opportunities for socially mediated reinforcement. Although gaze aversion may not come from a deficit in social skills knowledge, it does contribute to the cognitive manifestation that results in social anxiety (Schneier et al., 2011).

Researchers have primarily studied gaze aversion in adult patients with SAD; however, Kleberg et al. (2021) evaluated eye contact in children with SAD. They found children shifted their gaze quickly from the eyes to the mouth when presented with happy faces but did so more

slowly when presented with angry or neutral faces. Put differently, children with SAD attended longer to aversive stimuli than to potentially reinforcing stimuli; this tendency could lead to an increase in arousal that exemplifies the negative experiences associated with eye contact. Likewise, an inflexibility in shifting gaze may eventually lead to avoidance of social situations and subsequent reduction in eye contact in adulthood. These findings illustrate the need to identify not only socially validated levels of eye contact but also appropriate levels as it relates to the role of eye contact in the development of SAD.

Children in out-of-home care such as foster care may benefit from increases in eye contact thereby facilitating trust and secure attachment, issues often expressed by this population (e.g., Purvis et al., 2013; Rees, 2020). Reportedly, these issues may give rise to challenging behaviors and emotional instability. Purvis et al. (2013) proposed a therapeutic approach to increasing appropriate behaviors and decreasing challenging behaviors for children and youth in foster care called the connecting principles. These principles closely resemble the behaviors demonstrated in the establishment of a healthy mother-and-infant bond. Eye contact is a crucial component of the principles, and the therapy sessions foster this skill paired with playful touch and affection.

Subsequently, Purvis et al. (2015) evaluated the effectiveness of the connecting principles in an experimental study. They recruited 96 adoptive parents and assigned half to the intervention group and the other half served as control. All families completed the Strengths and Difficulties Questionnaire and the Trauma Symptom Checklist for Young Children. The intervention group received a four-day online training using the trust-based relational intervention, which included the connecting principles along with two other sets of principles,

empowering and correcting[3]. Purvis et al. found significantly lower caregiver reports of the child's emotional and conduct issues at post-test versus pre-test for the intervention group but found no significant change over time for the control group. Moreover, caregivers reported higher prosocial behaviors for the intervention group. Notable limitations of this study are the lack of direct eye contact measurement and the absence of formal outcome training criteria. However, given the work of other researchers (e.g., Babinet et al., 2021; Cui et al., 2019), eye contact is likely a crucial component of any intervention to increase trust and secure attachment for foster children.

As previously noted, researchers have confirmed the association between gaze pattern impairments and the development of CU traits across ages that characterize behavioral disorders such as emotional behavioral disorder (EBD; Bedford et al., 2015; Billeci et al., 2019; Dadds et al., 2008; Demetriou & Fanti, 2022; Levantini et al., 2022; Martin-Key et al., 2018). As early as infancy, reduced face preference can indicate the potential for the development of CU traits in later childhood (Bedford et al., 2015; Dadds et al., 2011). Specifically, results from Dadds et al. (2011) suggested a lack of attention to the eyes of an attachment figure in infancy gives rise to social and empathy deficits demonstrated by children with high CU traits.

Researchers suggest that gaze impairment in individuals diagnosed with EBD reduces the ability of an individual to attend to relevant social and emotional cues communicated through eye contact and other facial cues. Levantini et al. (2022) revealed individuals with higher CU traits shifted their gaze more rapidly from the faces of others. This quick shift in gaze may cause the individual to miss meaningful information. Failure to attend to facial social cues may also result in less responsiveness to parental displays of affection, further facilitating the development

[3] Many of the intervention components are similar to behavioral interventions.

of CU traits (Levantini et al., 2022). Additionally, studies have suggested CU traits are heritable (Viding et al., 2005, 2007, 2008; Waller & Hyde, 2018); however, researchers have speculated that parenting also plays a substantial role in the development of these traits (Levantini et al., 2022; Waller & Hyde, 2018). To this end, Levantini et al. examined the impact of differences in gaze patterns moderated by parenting practices on the presence of CU traits. Their results indicated that eye gaze impairment negatively correlated with the severity of CU traits, regardless of positive (e.g., caring environment) or negative (e.g., harsh discipline) parenting practices. Although positive parenting appeared to be a protective factor against the development of CU traits in the Levantini et al. study, it could not offset the impact of impaired gaze. Notably, negative parenting practices combined with gaze impairment posed the greatest risk for severe outcomes. Thus, eye contact and interventions related to the improvement of gaze patterns could benefit individuals with high CU traits, behavioral disorders, or both.

In children, CU traits serve as a precursor to psychopathic traits, both of which predict offending (Halty, 2019; McCuish et al., 2014), furthering the need to address eye contact deficits early in life (Gehrer et al., 2020, 2021). A population of specific interest in this study is adolescents in the juvenile justice system. Justice-involved adolescents with or without CU traits may have deficits in all social skills including eye contact (Snow & Powell, 2008). In a descriptive study, Sanger et al. (2000) recorded conversation skill deficits in justice-involved adolescents that included poor eye contact, even when they demonstrated the ability to verbally describe eye contact as an important conversation skill. Furthermore, reduced eye contact can delay treatment outcomes by conveying to victims and court officials a lack of remorse (Suzuki & Wood, 2018). In addition to the stigma adolescent offenders experience for the crime they committed, deficits in eye gaze may exacerbate their social isolation.

Understanding eye contact within criminal offending populations may lead to interventions that prevent or reduce offending. As previously noted, researchers speculate that attention to another person's eyes may facilitate the development of empathy, a characteristic lacking for many offenders. To study the role of eye contact in adult male offenders, Gehrer et al. (2020) used an eye-tracking device to assess attention given to different areas of facial regions. They found that higher scores of affective psychopathy predicted reduced eye contact and increased attention to the lower part of the face. Likewise, Gehrer et al. (2021) found similar results when assessing eye contact in a large sample of male and female adult offenders, in addition to a reduced ability to identify fearful faces. Consequently, impairment in eye contact and attention to the eyes might compromise cognitive development and facilitate antisocial or deviant behavior typical of offenders (Dadds et al., 2012; Gehrer et al., 2020, 2021; Waller & Hyde, 2018).

Finally, a well-known population impacted by eye contact are those diagnosed with ASD. Lack of eye contact is a defining behavioral feature of ASD (American Psychiatric Association, 2022). Although it is unknown why individuals diagnosed with ASD have eye contact deficits, this impairment may negatively impact social interactions (Aubé et al., 2021), decrease the likelihood of responding to relevant stimuli (e.g., prompts) when learning, and inhibit emotion detection (Alvari et al., 2021; Carbone et al., 2013; Cook et al., 2017; Fonger & Mallot, 2019). Researchers have shown that individuals diagnosed with ASD process direct gaze differently from infancy (Elsabbaugh et al., 2012; Falck-Ytter et al., 2015; Grice et al., 2005; Kylliainen et al., 2006; Senju et al., 2005). These early differences may contribute to long-term negative outcomes.

There are several theories as to why individuals diagnosed with ASD exhibit low eye contact. One theory is the gaze aversion hypothesis which suggests that individuals diagnosed with ASD avoid direct eye contact because they perceive it as threatening. Wang et al. (2018) investigated this hypothesis in a study with 30 children diagnosed with ASD and 31 typically developing children. They used an integrated eye tracker and presentation desktop to display pictures of faces with instructions to freely look at the face. Each of the 16 pictures displayed one of four facial expressions. For the analysis, Wang et al. calculated the proportion of time looking at the areas of interest. Then they used repeated measures ANOVA to determine differences in groups and expressions for proportional eye-looking time. Children diagnosed with ASD had shorter dwell times than typically developing participants. Furthermore, additional analyses revealed moderation of group differences by expression, specifically angry expressions. The researchers theorize their results may support the gaze aversion hypothesis because individuals diagnosed with ASD had reduced eye gaze for socially threatening stimuli.

Several other researchers have also investigated eye gaze and ASD. For instance, Alvari et al. (2021) used advanced artificial intelligence eye-tracking in naturalistic environments to assess the correlation of eye contact with the level of social symptoms and motor function for 85 children diagnosed with ASD. The advanced artificial intelligence eye-tracking consisted of using OpenPose and Gaze360 to compute gaze vectors between a child and therapist during a session. This process of eye-tracking allowed for the most naturalistic observations because the child and therapist interacted without the constraints of an eye-tracking apparatus. Alvari et al. evaluated the relation between eye contact and cognitive functioning and social abilities. Additionally, they used stratification to assess spectrum heterogeneity. Low levels of eye contact correlated positively with higher levels of social impairment, but not with cognitive functioning.

That is, children exhibiting a higher severity of social skills and hand-eye coordination deficits displayed less eye contact with their therapist. The stratification analysis revealed two major levels of functioning; one group displayed milder symptoms and the other group with a higher degree of symptom severity. The milder symptom group displayed a higher frequency and duration of eye contact episodes. The results from Alvari et al. suggested a critical relation between low eye contact and high social skills deficits and symptomology for children with ASD.

Additionally, Hirsch et al. (2021) compared eye contact avoidance in individuals diagnosed with ASD to typically developing adults. They used a two-person neural imaging system with eye-tracking where they recorded eye gaze during either live or recorded interactions. They led the participants through a series of 3 s cycles wherein they either did or did not gaze at the other person's eyes, followed by a 15 s rest period. Simultaneously, the researchers measured participants' neural activity using functional near-infrared spectroscopy. Hirsch et al. used linear mixed-effects models to assess dwell time between the two groups and two conditions. They found the neural systems activated by live eye contact differed between typically developing individuals and those with ASD. Individuals with ASD had less systematic gaze behavior and avoided central-face features. Hirsh et al. suggested that gaze fixation may be associated with stronger emotional responding for individuals with ASD. They also suggested their findings support a bottom-up theory for deficits in live eye-to-eye contact whereby incoming information distorts, thereby impairing higher-order processing for faces and social interactions. The Hirsch et al. study provided a preliminary understanding of multiple processes impacting gaze aversion for individuals diagnosed with ASD.

Behavioral Interventions to Improve Eye Contact

Given the developmental and social importance of eye contact, researchers have sought and evaluated interventions targeting the latency to, frequency of, and duration of eye contact. The development of many of these interventions occurred for children and adolescents diagnosed with ASD and related neurodevelopmental disorders. This section describes interventions that target eye gaze as the dependent variable and multicomponent interventions that target multiple dependent variables (i.e., communication skills) including eye gaze. The former studies often involved individualized, focused interventions for participants with limited verbal abilities whereas the latter often involved multicomponent group intervention for participants with developed verbal repertoires.

Focused Interventions

Shaping is the process of differential reinforcement of successive approximations to a terminal behavior (e.g., Cooper et al., 2019). Clinicians use shaping, in conjunction with other behavioral procedures, to increase a variety of behaviors including eye contact. In a noteworthy study, Hall et al. (2009) used percentile schedules, which rely on shaping and response variability, to increase the duration of eye contact for six individuals with Fragile X syndrome. For three of the participants, the researchers added a functional movement training (overcorrection) component (i.e., positive punishment). The duration of eye contact increased for five of the six participants; however, it is likely individuals engaged in eye contact to avoid the overcorrection. In this case, eye contact may be maintained through negative reinforcement even though it might produce aversive emotions for the individual. This study is notably limited insofar as the researchers did not assess maintenance of eye contact over time or any form of generalization (e.g., setting, peer interaction, etc.). Additionally, the authors did not have predetermined acquisition criteria.

Fonger and Malott (2019) evaluated the usefulness of shaping in increasing eye contact for three young children diagnosed with ASD. This intervention targeted the latency to eye contact and duration of eye contact. To facilitate eye contact, the instructor removed a preferred toy and reinforced eye gaze with 15 s of access to the item contingent on eye contact. In the initial phases, the instructor reinforced any orientation of the child's eyes to the instructor's body. In phases 1-4, duration shaping began where the instructor reinforced any duration over 1 s with progressive 1 s increments until duration reached 3 s within 5 s of the removal of the stimulus (i.e., toy). The authors chose 3 s as the target duration because of the rationale that it is approximately the length of time required to observe any necessary instructional components of a discrete trial. Phases 5-6 occurred after eye contact became quick and sustained (i.e., within 5 s of stimulus removal for a duration of 3 s). In the last two phases, instructors gave an unreinforced high-probability instruction when the child made eye contact after the removal of the stimulus, then waited for a second instance of eye contact. The authors measured acquisition by the percentage of correct trials (i.e., eye contact within 5 s with a duration of 3 s) at 80% or above for three consecutive sessions. Additionally, they trained across trainers and locations for generalization. All three participants acquired quick and sustained eye contact, which maintained over time as demonstrated in one-month follow-ups. Note that for one participant the instructor added edibles that could not be faded without decreases in eye contact below the acquisition criterion. Although they assessed generalization with novel instructors, they did not assess generalization to social contexts which is crucial for the early development of social skills, as mentioned earlier.

In another study that evaluated a multicomponent intervention, O'Handley et al. (2015) used social stories and video modeling, individually and then combined, to increase the duration

of eye contact for six adolescents with either an intellectual disability or ASD. Social stories are brief, individualized narratives that describe social concepts and appropriate responses given certain contexts (Gray, 2000; O' Handley et al., 2015). The social story intervention consisted of using a tablet to watch a 45 s long social story followed by a 3 min conversation probe with the researcher. The video modeling intervention consisted of the same format with a video length of 3 min and 45 s. To evaluate combining the two interventions, the researchers placed the participants in two groups and counterbalanced combining the interventions. O'Handley et al. measured the total duration of eye contact during 3 min conversation probes, intending to increase from baseline to intervention phases but without predetermined acquisition criteria. Results indicated social stories, alone, produced a weak effect for one participant and a strong effect for the other two individuals determined by non-overlap of all pairs and Tau-U. Video modeling, alone, produced a strong effect for all three participants. When they compared video modeling (alone) to the combined intervention, they found a mostly weak effect. However, when they compared social stories (alone) to the combined intervention, they found a strong effect. Overall, all the interventions increased eye contact with video modeling demonstrating a consistent and strong effect alone or when combined with social stories. O'Handley et al. did not evaluate maintenance of eye contact; however, they did measure generalization with novel conversation partners. Importantly, individuals who can acquire skills via video modeling and social stories likely have a developed learner's repertoire. Thus, it is unclear whether this intervention would provide the same effect for early, developing learners.

Response to name (RTN) is a foundational skill acquired in early childhood in which the individual responds by looking at the face of the person who said their name. Cook et al. (2017) evaluated the effects of a sequential model designed to increase eye contact for individuals

diagnosed with ASD in response to their names. The model consists of phases in which the practitioner can sequentially implement various levels of intervention to address idiosyncratic learning without negative reinforcement. The model phases include contingent praise only, contingent edibles plus praise, stimulus prompts plus contingent edibles and praise, contingent video plus praise, alternative simulation (i.e., generalization), schedule thinning, and maintenance. The intention of the progressive model was for clinicians to implement the intervention starting with the least complex phase that resulted in acquisition, then progressively move through the phases until acquisition occurred. After acquisition, the clinician would the reinforcement schedule and assess the maintenance of eye contact after some time. Cook et al. evaluated this intervention for 21 children diagnosed with ASD. The authors measured the increase in eye contact by the percentage of correct trials (i.e., eye contact in RTN within 3 s for a duration of 1 s) with acquisition criteria set at 80% or above for five consecutive sessions. Eye contact increased to at or above the set criteria for all participants with varying levels of intervention and modifications. The progressive model gave clinicians a prescribed method to increase eye contact, but several of the participants required additional reinforcers (i.e., tangible or edible consequences) to maintain their acquisition criteria. Additionally, Cook et al. did not assess eye contact within the context of social interactions when a peer may try to initiate a social interaction by calling the individual's name.

Subsequently, Rapp et al. (2019) used the same progressive model, designs, and acquisition criteria for 15 children diagnosed with ASD. For 11 of the 15 participants, eye contact increased with some level of intervention. Like Cook et al. (2017), they found eye contact maintained for 10 of the 11 individuals up to 19 weeks post-intervention. Rapp et al. found that 17 of the 18 participants maintained eye contact when evaluated up to two years later.

Both Cook et al. and Rapp et al. conducted extensive maintenance assessments and found that eye contact typically persisted often and increased over time. They speculated this finding indicated the participants contacted various non-programmed reinforcers in their natural environment when engaging in eye contact. Additionally, the authors assessed generalization to the natural environment for some participants. Like Cook et al., this study has the limitation of not assessing generalization in natural contexts during peer social interactions.

Additionally, Conine, Vollmer, and Bolivar (2020) evaluated the effects of a series of interventions measured through the percentage of correct trials, sequenced in an additive component analysis to increase RTN for four children diagnosed with ASD. Throughout the four intervention phases, the authors systematically tested the response to the individual's name as well as irrelevant names. For the first intervention, the authors evaluated the use of repeated practice and exposure to the types of social interaction that might follow RTN in the natural environment (i.e., joint attention). For the second intervention, they included the use of prompts with social interactions (e.g., vocal tap, “Look at me”). The third intervention assessed the use of edible reinforcement simultaneous to social interaction. The authors made several modifications depending on the participant such as leisure and differential reinforcement. Conine, Vollmer, and Bolivar (2020) defined a successful trial to be any duration of eye contact within 5 s of them calling the individual’s name with the acquisition criteria set at 80% or above for three consecutive sessions. Due to reports of sustained eye contact being aversive for some individuals with ASD, they counted any duration as correct responding. Additionally, they assessed the generalization of RTN in varied locations with a novel experimenter; however, they did not assess generalization to peers during social interactions. Conine, Vollmer, and Bolivar (2020) found all participants increased RTN and decreased their response to other names. However,

social interaction did not increase RTN without the addition of contrived reinforcers (i.e., edible and tangible reinforcers). Although the participants needed contrived reinforcers to achieve RTN, the researchers thinned the schedule of reinforcement to an average of one reinforcer per session.

In a subsequent study, Conine, Vollmer, Barlow, et al. (2020) evaluated increasing RTN using differential reinforcement with varying reinforcer magnitudes, prompts, and interruptions (i.e., temporarily blocking access to distractor items and/or stereotypy) starting with only differential reinforcement and adding components sequentially. They used the same design and eye contact measurement as Conine, Vollmer, and Bolivar (2020); however, they set their acquisition criteria at 67%[4] for three consecutive sessions and a discrimination index of 0.8 or greater. They calculated the discrimination index by summing the percentage of RTN across three sessions and dividing that sum by the sum of percentage RTN and response to other names for the same three sessions. Although Conine, Vollmer, Barlow, et al. (2020) assessed RTN in generalized settings with a novel experimenter, they did not assess generalization to peer social contexts. Nine of the children needed additional components to sufficiently increase RTN; however, all 13 children achieved the ability to RTN consistently. Both Conine, Vollmer, and Bolivar (2020) and Conine, Vollmer, Barlow, et al. (2020) had limitations due to the absence of duration measures.

Most recently, Lee et al. (2022) expanded on previous research (e.g., Conine, Vollmer, Barlow, et al., 2020; Rapp et al., 2019) by using edibles and prompts to increase RTN *and* gaze following for two children diagnosed with ASD. The intervention for both behaviors consisted of four different phases starting with an edible prompt, then fading to a ½ edible and ½ finger

[4] They lowered the acquisition criteria to 67% because in Conine, Vollmer, Barlow, et al. (2020) had to lower the criteria to 70% for some participants. Given how they blocked their trials, 67% was the closest percentage.

prompt, then only finger, and finally independent responding. The authors included tangible reinforcers after independent responding started to occur, then transitioned to intermittent reinforcement or full removal of the tangible reinforcers. Lee et al. measured independent eye contact and gaze before and after interventions and included generalization probes in free play settings. They used the criteria of RTN by the child making eye contact within 3 s after the delivery of the antecedent (e.g., name call) for a duration of 5 s. For gaze following, the authors defined a correct response as touching or pointing to the item the instructor shifted their gaze to within 3 s of hearing the antecedent, “What is the teacher looking at?”. They set their acquisition criteria at 90% or above for two consecutive sessions for each training phase. Both children acquired both skills with generalization to free play settings and demonstrated the maintenance of these skills one month after training; however, one child needed tokens along with social reinforcers to maintain eye contact. As with several of the previous studies, Lee et al. used criteria mainly established for skill acquisition (i.e., not socially validated) and did not assess for generalization to peer social interactions.

Lastly, Muuvila et al. (2022) evaluated the feasibility of a brief parent-mediated intervention to motivate eye gaze from children diagnosed with ASD. They measured eye gaze (i.e., the frequency of the child’s eyes oriented to the parent's face) and state of engagement (e.g., engaged with the parent, an object, or unengaged). They used an intervention where parents required eye gaze during requests for the child to obtain the item. They hoped that through this intervention they would link eye gazing to positive affect. Muuvila et al. (2022) observed increases in eye contact and improved child and parent engagement.

Overall researchers have attempted to develop interventions to specifically target increasing eye gaze. These interventions include shaping, differential reinforcement, percentile

schedules with overcorrection, social stories, video modeling, and progressive multi-component models. Each of the studies increased eye gaze to some extent and Cook et al. (2017) and Rapp et al. (2019) found their participants' eye contact either maintained or increased over time. However, each study had one or more limitations. For instance, some studies measured the percentage of correct trials as the dependent variable, whereas the duration of eye gaze seems more relevant or at least a necessary additional dependent variable. Those that did measure duration varied in their acquisition criteria or trained without acquisition criteria. Across all the studies, researchers either had acquisition criteria based on the available research for skill acquisition or had no determinable criteria. Undoubtedly, the lack of normative data results in training programs without socially valid acquisition criteria. Given the importance of the learner contacting socially mediated reinforcement to maintain and further develop social skills, it is concerning that none of these studies evaluated peer perception, initiation of interaction by peers, or duration of social interactions before and after training. Considering the complexity of social interactions, multiple variables and dimensions of eye gaze are important for assessment and intervention. This not only applies to interventions targeting only eye contact but those that target eye contact in addition to other communicative behaviors.

Multicomponent Interventions

Interventions have also included eye contact as one of several communicative behaviors needed for successful social interactions. For instance, Bauminger (2002) evaluated the effectiveness of a 7-month cognitive-behavioral therapy (CBT) intervention targeting social-emotional understanding and social interaction for 15 children with ASD. They used a coding scale based on the Behavior Coding Scheme for children with ASD to observe social interactions in the child's natural environment (Hauck et al., 1995). The coding for positive social

interactions included eye contact defined as any instance (no defined time requirement) a child looks into the eyes of another child. The authors completed four observations, two before intervention and two after where observers recorded interactions based on the predefined codes. The program demonstrated an increase in eye contact and their ability to share experiences with peers and show interest. Additionally, teachers rated their social skills higher than in pre-intervention. Bauminger (2007) replicated these findings with 26 pre-adolescent children diagnosed with ASD within group settings. During observations, the researchers recorded the behaviors of the children with the same coding system used in Bauminger (2002) and after the observation, they rated the behaviors (e.g., eye contact) on a 5-point Likert scale denoting the frequency of the observed behaviors (e.g., 1 = did not appear at all, 4 = appeared more than 50% of the time). Notably, the observers used their perception to rate the frequency of eye contact. Neither study used acquisition criteria to determine training outcomes or assessed maintenance.

Eye contact is a component in other training packages using CBT (Crooke et al., 2008; Danial & Wood, 2013); however, CBT is not the only packaged program targeting communicative behaviors including eye contact. Several researchers have evaluated the use of the Program for the Education and Enrichment of Relational Skills (PEERS®) to indirectly increase eye contact. PEERS® is an empirically supported social skills program for youth with ASD (e.g., Chien et al., 2021; Laugeson et al., 2009, 2012; Laugeson & Park, 2014; Van Hecke et al., 2015). One aspect of the PEERS® curriculum teaches individuals how to discriminate social cues (i.e., social perception). The individuals practice entering a group conversation through role-playing. The clinicians teach participants to look for three concrete behaviors, one of which is eye contact (Laugeson & Park, 2014). Most studies using the PEERS® curriculum have not measured eye contact; however, Chien et al. (2021) did evaluate eye contact and other

communicative behaviors. Although they measured eye contact using the Communicative Behavior Observatory Scale (CBOS) rather than a more objective method, Chien et al. found a significant trend test increase in maintaining eye contact in a conversation for Taiwanese young adults from pre- to post-intervention. Like Bauminger (2007), observers rating the CBOS used their own perception of eye contact to score this assessment.

As previously noted, social stories and video modeling are other interventions used for increasing eye contact. Soenksen and Alper (2006) used social stories to teach a child with hyperlexia how to gain the attention of their peers. The intervention targeted looking at the face of the peer while talking and saying a peer's name, two behaviors deemed important for social interaction initiation. Soenksen and Alper used the number of attempts made to obtain peer attention during 15 min observations as their eye gaze measurement. They defined successful attempts by saying the peer's name and looking at the peer's face. Importantly, the authors used observations of the participant's peers to determine the training criterion (i.e., social comparison). In addition, they obtained social validity by consulting with the participant and his parents to select eye gaze as a target behavior. They set their acquisition criteria at three consecutive sessions at the social comparison criteria for both target behaviors. The individual's ability to look at a peer’s face increased in frequency across three different settings and maintained 49 days later.

Subsequently, Pierson and Glaeser (2007) used a variation of social stories in the form of comic strip conversations to increase eye contact and other appropriate social behaviors for three students in a school setting. Qualitative data indicated an increase in all behaviors. Most recently, Tang et al. (2022) conducted a randomized control trial to increase eye gaze using a storytelling app measured through an eye-tracking device. Researchers compared two groups, each

consisting of typically developed individuals and individuals with a diagnosis of ASD. Both groups received the intervention of four social stories, but one group had social contextual information and one did not. For the group with the social contextual information, results indicated an increase in eye gaze for individuals considered typically developed *and* individuals with a diagnosis of ASD.

As illustrated by the O'Handley et al. (2015) study, sometimes researchers combine social stories with other interventions. Before demonstrating the combined effects of social stories and video modeling, Tetreault and Lerman (2010) used point-of-view video modeling and reinforcement for target behaviors to teach social skills to three children diagnosed with ASD. They evaluated the effect of the intervention on eye contact and other social behaviors. The authors chose to score instances of eye contact as any duration within 2 s of the vocal stimulus. They set their acquisition criteria to eight out of 10 opportunities (i.e., 80%) to engage in independent eye contact with correct vocal behaviors across three consecutive sessions. Video modeling increased eye contact for two of the three participants, but both behaviors had low generalization. However, eye contact generalized relatively better than vocal behaviors. Two of the three participants needed the addition of either contrived reinforcers or prompts to increase all social skills. All participants demonstrated continued skill acquisition during follow-up sessions 10 days after the last intervention session. Subsequently, Mason et al. (2012) evaluated the impact of using video modeling in isolation on the communicative social skills of two college students diagnosed with ASD. The researchers used 1-2 min videos that included explicit instructions for each skill. The authors measured each skill by rating the skills on a 9-point Likert scale (e.g., 1 = absence of the skill, 7 = uses some eye contact for some purposes, etc.). Each

skill, including eye contact, increased significantly with a large effect size. Again, the observers used their perception of eye contact to rate the presence and level of the participant's eye contact.

Overall, researchers have used CBT, PEERS®, social stories, and video modeling to specifically target communicative behavior including eye contact. All the interventions demonstrated the ability to increase eye contact; however, many of the studies used subjective measurements. None of the studies used clear acquisition criteria, as with interventions specifically targeting eye contact, which is expected given the absence of normative data for eye contact and related social behaviors.

Acquisition Training Criteria

The detailed research discussed in this review assessed interventions that demonstrated the ability to increase eye gaze; however, the criteria for producing socially valid changes remain unestablished. Jongerius et al. (2020) identified a lack of a universal definition for eye contact and a valid measurement system as barriers to measuring normative levels of eye contact in human interactions. The ambiguity of training criteria may give rise to interventions that over-or under-train eye contact or may target eye contact unnecessarily (i.e., the individual already had a normative level of eye contact). One method of establishing acquisition training criteria might be to determine normative levels of eye contact; some researchers have attempted to do this using descriptive assessments. For example, Ashear and Snortum (1971) discovered for 90 pairs of adults and children, younger children (i.e., kindergarten) interacting with each other engaged in more eye contact than older children (i.e., fifth grade). By contrast, Levine and Sutton-Smith (1973) found the amount of eye contact or gaze while engaged in conversation between adult-child and adult-adult dyads increased with age from 33% in 4-to-5-year-olds to 59% for adults. Their finding that adult-adult dyads engaged in the most amount of eye contact may not

generalize to children. Likewise, criteria for training should reflect socially valid levels that may change across the lifespan.

Subsequently, Arnold et al. (2000) evaluated eye contact in child-to-child social interactions during play. Unlike the previous studies, the child-child (5- to 10-year-olds) interactions occurred with familiar individuals rather than novel dyads. The researchers divided the children into groups with toys and measured eye contact, joint attention, and object engagement. They found that children in playgroups engaged in relatively low amounts of eye contact (an average of 18% in 10 min intervals). Object engagement resulted in the highest percentage of engagement, which may have impacted the decreased level of eye contact observed. Based on their findings, the authors suggested that practitioners limit the training of eye contact to 20% of interaction time. Although their study suggested training low levels of eye contact in younger children is sufficient, the findings also suggest the context of the interaction likely influences the level of eye contact.

Furthermore, Rogers et al. (2018) used dual eye tracking via Tobii Glasses to evaluate personal gaze patterns during social interactions. They found that eye and mouth gaze patterns varied across but remained consistent within individuals. On average, mutual face gaze occurred for about 60% of a 4 min conversation and usually for brief bouts (i.e., 2.2 s on average). Whereas mutual eye contact only occurred for 0 - 45% of the conversation. Interestingly, when the researchers asked participants to rate their subjective perceived eye contact, they rated eye contact as having occurred for approximately 70% of the conversation. Rogers et al. suggested that they likely perceived *face* gaze as *eye* contact. This is an important finding because it suggests that the perception of eye contact is likely higher than eye contact itself. To note a

limitation, failure to screen for diagnoses that may impact eye gaze could have influenced the results.

Recently, Nuhu and Rapp (2020) began working toward empirically validated criteria for training eye contact by conducting descriptive analyses of behavior during social interactions. From a sample of 217 undergraduate students aged 18 - 27, they found three unique profiles emerged. Across all three profiles levels of eye contact remained high (above 80%, but not as high as 100%). Additionally, they measured vocalizations, head/shoulder movements, and hand movements. Unfortunately, they did not measure smiling which is another notable social behavior as suggested by previous researchers (e.g., Cortez et al., 2017). Although they did not measure the duration or frequency of each instance of eye contact, the results indicated most participants had at least brief periods of no eye contact. Therefore, individuals may consider continuous (i.e., 100% eye contact) as not typical. Moreover, participants displayed varying levels of the other tracked communicative behaviors (i.e., head and shoulder movements, vocalizations, and hand movements). Combined with the findings of the previous eye gaze studies, researchers could speculate that the normal development of eye gaze increases over an individual's lifespan as they contact continued reinforcement in their environment.

The perception of others may hinder or promote levels of reinforcement for eye gaze. For example, individuals with ASD who may have the verbal ability to engage in speaker-listener exchanges (i.e., conversation) might signal to others through averted gaze that reinforcement is not available (i.e., s-delta). People in the individual's environment may respond to the s-delta by avoiding or limiting their verbal interactions. How others perceive individuals when eye contact or gaze remains low during social interactions may impact social acceptance and development, especially for at-risk (e.g., adolescents with high CU traits who have not offended) or justice-

involved adolescents. Not only could studies about others' perception of eye gaze help establish normative levels for training programs targeting eye gaze, but they could also facilitate training programs for individuals to overlook the absence of gaze and alter the value of other social reinforcers (e.g., shared interests). Additionally, discovering how an impacted population (i.e., justice-involved adolescents) perceives others' eye gaze could offer important information for rehabilitation and reintegration efforts.

Bush et al. (2022) investigated the question of others' perceptions by exploring social validity ratings for the three profiles established by Nuhu and Rapp (2020). To recreate the profiles found in the first study, the researchers filmed a conversation between two individuals (one who was on- and one who was off-camera). From this video, the authors created a script and mapped out the behaviors using continuous data recording to lay out exactly which seconds in the 5 min video would display the target behaviors. They made three videos to represent the three profiles used in Nuhu and Rapp (2020). To validate the profiles, they asked undergraduate students (i.e., participants) to rate each profile on a 6-point Likert scale for six statements. Participants then took the Test of Adolescent Social Skill Knowledge (TASSK) social skills questionnaire. In this study, they found the participants rated one profile more favorably than the other two (i.e., a "socially validated" profile). This profile consisted of high levels of eye gaze (87.3%), moderate amounts of head/shoulder movements (62.7%) and vocalizations (64.7%), and low levels of hand movements (19.3%).

In a second study, they evaluated the differences in ratings for the "socially validated" (87.3% eye gaze) profile compared to a high eye gaze (96%) and low eye gaze (52%) profile, where all other behaviors remained at the levels of the "socially validated" profile. They found participants rated the high and "socially validated" eye gaze profiles higher on positive social

components and lower on negative social components when compared to the speaker in the low eye gaze profile. The level of eye gaze also seemed to impact the rating of the nonverbal behaviors held constant in all three profiles, indicating eye gaze may impact the perception of additional social behaviors.

Current Study

To explore the role of eye contact in social situations, the current study sought to replicate Bush et al. (2022: Study 2) with two adolescent groups: (a) students in an urban high school (i.e., non-justice-involved youth) and (b) residents in a juvenile-justice facility (i.e., justice-involved youth). As individuals enter their adolescent years, they become more independent in their development of social relationships, often seeking out individuals beyond their family (Manke et al., 1995; Oberle et al., 2011). During this significant period, individuals may become isolated, leading to negative life outcomes if they are unable to attain and maintain social relationships.

Furthermore, research has revealed low eye contact is correlated with high CU traits (e.g., Dadds et al., 2012, 2014), which is a central feature of psychopathy in youth. Low eye contact may also characterize justice-involved adolescents regardless of CU trait level (e.g., Hopkins et al., 2016; Snow & Powell, 2008) due to a diagnosis, general social skills deficits, or both. As a population at risk for serious antisocial outcomes who are potentially impacted by low eye gaze due to one or more factors, awareness of how they perceive others' eye gaze could inform researchers on their ability to detect relevant facial stimuli (i.e., eye contact provided by others); furthermore, it could lead to enhanced and customized interventions. Overall, understanding adolescents' perceptions of social behaviors, especially eye contact, may increase the likelihood of social inclusion and subsequently positive life outcomes for the various impacted populations.

In addition, identifying the level of eye contact adolescent peer groups view as normative may lead to educational materials for typically developing individuals and objective acquisition measures for interventions for individuals with low levels of eye contact.

Method

Participants and Settings

The researcher assessed social validity ratings and self-assessments for social skills with two groups: (a) non-justice-involved youth and (b) justice-involved youth. The researcher partnered with a high school in a southern state to recruit non-justice-involved students. The students ranged in grade level from the 10th to 12th grade, ages 15-18. The researcher partnered with an advanced placement psychology teacher to recruit a total of 52 students. The high school consisted of a primarily white population, specifically 61.4% white, 20.3% Black, 11.5% Asian, 4.8% Hispanic, 1.8% two or more races, and .05% American Indian (National Center for Education Statistics [NECS], 2020-2021 school year). The NECS also reported that 19% of students received free or reduced lunch. The U.S. Census Bureau depicted the location of the high school as a metropolitan area core with a small percentage (14.8%) of the area with high commuting (United States Department of Agriculture, 2013).

The juvenile justice-involved population consisted of 48 adolescent males aged 13 to 20 years old and court-ordered to receive accountability-based sex offender treatment. Their racial demographics comprised 66.7% white, 32.6% black, and 0.74% bi-racial individuals. They all resided in a secure residential facility where they received therapeutic services from a university-based program.

All non-justice-involved participants accessed the videos and questionnaires using their school-issued personal devices via Qualtrics™. Teachers offered time in their classes for

participation in the study. They printed and posted a sign advertising the study. Additionally, they sent home and collected parent-signed permission slips from each student who chose to participate. The authors did not offer extra credit for participation.

All participants[5] from the juvenile justice facility accessed the videos and questionnaires via Qualtrics™. They completed the same video assessments and questionnaire as the non-justice-involved youth. Additionally, the residents completed the Inventory for Callous-Unemotional (ICU; e.g., Cardinale & Marsh, 2020) traits youth self-report assessment.

Procedures

The researcher used the video profiles created by Bush et al. (2022) to assess the social validity of eye gaze among adolescents. Participants viewed the three different profiles and considered the same six statements following each of the videos: (a) the speaker looks normal, (b) you would talk to the speaker, (c) the speaker is inattentive, (d) the speaker cannot sit still, (e) the speaker would get an important job, and (f) the speaker would not have a lot of friends. A 6-point Likert scale rating, ranging from *not true at all* (0) to *very true* (5), assessed their opinion for each statement. Furthermore, because drawing attention to the eyes may impact the ability of an individual to detect differences in eye gaze and potentially their subsequent ratings, participants either received a written prompt before each video in Qualtrics™ asking the participant to "FOCUS on the speaker's EYES" or no prompt. This created a total of four groups: (a) non-justice-involved youth who did not receive a prompt, (b) non-justice-involved youth who received a prompt, (c) justice-involved youth who did not receive a prompt, and (d) justice-involved youth who received a prompt.

[5] Researchers obtained consent for the justice-involved adolescents through a representative of the facility. Furthermore, researchers obtained assent from each participant at the onset of each session.

At the beginning of the survey, participants had the option to download an information letter for them to read. If they opted to continue their participation, the screen advanced to the first video. The survey presented each video (high, "socially validated", and low eye gaze) one at a time with their corresponding statements. Previous research supports the ability of individuals to detect differences in dimensions of behavior during short video segments (Almanza et al., 2020; Coon & Rapp, 2020). The presentation of the videos and statements occurred through randomization, such that each participant viewed the three videos and answered the statements in random order. After the participants viewed the three videos and rated their corresponding statements, they completed a self-assessment of their social skills via the TASSK. For the justice-involved youth, a final step consisted of completing the ICU traits assessment. The researchers remained available during sessions with the justice-involved youth to answer any questions about wording and/or to read the written portions to them if requested.

Data Analysis

The data analysis consisted of using six 2 x 2 x 3 repeated measures ANOVAs (one for each statement) to compare within-subject ratings between the three profiles (i.e., high, "socially validated", and low eye contact) and between-subjects effects of the two conditions (i.e., prompt [n = 46] and no prompt [n = 54]) and groups (i.e., justice [n = 48] and non-justice involved adolescents[n = 52]). Regarding the TASSK and the impact it may have had on responding, the researcher first used an independent samples t-test to examine differences between the two groups of adolescents (i.e., non-justice-involved and justice-involved youth). Based on the results of that test, the researcher combined the groups and conducted six 3 x 3 repeated measures ANOVA to evaluate responses for each question across profiles and TASSK ranking (i.e., Low, Moderate, High). In the same manner as Bush et al. (2022), each participant's self-

assessment from the TASSK created a total numerical score which the researcher used to categorize each participant into one of three groups: Low (score of 10 to 15), Moderate (score of 16 or 17), and High (score of 18 to 23). The group categorizations described their self-assessed level of social skills (e.g., a higher score equaled greater social skills knowledge). Lastly, the researcher examined responses for each question across profiles and ICU Ranking (i.e., Low, score of less than 37; or High, score of 37 or above) using a 2 x 3 repeated measures ANOVA. Subsequently, the researcher conducted pairwise comparisons for all the mixed ANOVAs using Bonferroni post hoc tests.

Results

Differences in Profile Ratings Across Statements for Group and Condition

The researcher conducted six 2 x 2 x 3 repeated measures ANOVAs to compare the participants' ratings of the six statements corresponding to the three different profiles, one for each statement (e.g., "The speaker looks normal") across conditions (i.e., prompt or no prompt) and groups (i.e., non-justice and justice-involved youth). Table 1 displays the post hoc results of the within-subject 2 x 2 x 3 repeated measures ANOVAs for all the adolescents' profile ratings. Figure 1 displays box plots for each profile across statements.

Statement 1: The speaker looks normal.

The analysis for Statement 1 (i.e., "The speaker looks normal") revealed an overall significant effect of profile (F (2, 96) = 17.74, $p < .001$), and no effect for condition (F (1, 96) = 0.51, $p = 0.48$) or group (F (1, 96) = 1.24, $p = 0.27$). Post hoc tests compared the ratings for Statement 1 across the three profiles and indicated a statistically lower rating for the low eye contact profile compared to the "socially validated" and high eye contact profile. The analysis revealed no significant difference between the high eye contact and "socially validated" profiles.

This suggests the adolescents perceived the low eye contact profile as less "normal" than the other two profiles. The prompt to focus on the eyes did not have a significant impact on ratings. Likewise, ratings did not significantly differ between the non-justice and justice-involved youth.

Statement 2: You would talk to the speaker.

The analysis for Statement 2 (i.e., "You would talk to the speaker") revealed an overall significant effect of profile (F (2, 96) = 6.76, p = 0.01) and no effect for condition (F (1, 96) = 1.23, p = 0.27) or group (F (1, 96) = 2.84, p = 0.10). Post hoc tests compared the ratings for Statement 2 across the three profiles and indicated a statistically significant lower rating for the low eye contact profile, as compared to both the high eye contact and "socially validated" profile. The analysis revealed no significant difference between the high eye contact and "socially validated" profiles. This outcome suggests that the adolescents would be more likely to talk to the speaker emitting higher amounts of eye contact. The prompt to focus on the eyes did not have a significant impact on ratings. Likewise, ratings did not significantly differ between the non-justice and justice-involved youth.

Statement 3: The speaker is inattentive.

The analysis for Statement 3 (i.e., "The speaker is inattentive") revealed an overall significant effect of profile (F (2, 96) = 16.46, p < .001) and group (F (1, 96) = 4.07, p = 0.04) but no effect for condition (F (1, 96) = 0.23, p = 0.64). Post hoc tests compared the ratings for Statement 3 across the three profiles and indicated a statistically higher rating for the low eye contact profile compared to the high eye contact and "socially validated" profiles. The analysis revealed no significant difference between the high eye contact and "socially validated" profiles. This finding suggests that the adolescents viewed the actor with low eye contact as less attentive during the conversation. Additionally, post hoc tests compared the ratings for the three profiles

by group. The analysis revealed that non-justice-involved youth (M = 1.74, SE = 0.22) rated the high eye contact profile significantly higher (p = 0.04) than the justice-involved youth (M = 1.11, SE = 0.23). The prompt to focus on the eyes did not have a significant impact on ratings.

Statement 4: The speaker cannot sit still.

The analysis for Statement 4 (i.e., "The speaker cannot sit still") revealed an overall significant effect of profile (F (2, 96) = 14.82, p < .001) and no effect for condition (F (1, 96) = 0.04, p = 0.85) or group (F (1, 96) = 0.001, p = 0.98). Post hoc tests compared the ratings for Statement 4 across the three profiles and indicated a statistically higher rating for the low eye contact profile, as compared to the high eye contact and "socially validated" profiles. The analysis revealed no significant difference between the high eye contact and "socially validated" profiles. This outcome suggests that the adolescents perceived the low eye contact profile as though they could not sit still even though the speaker held all other movements constant across profiles. The prompt to focus on the eyes did not have a significant impact on ratings. Likewise, ratings did not significantly differ between the non-justice and justice-involved youth.

Statement 5: The speaker would get an important job.

The analysis for Statement 5 (i.e., "The speaker would get an important job") revealed an overall significant effect of profile (F (2, 96) = 11.91, p < .001) and group (F (1, 96) = 3.98, p = 0.04) but no effect for condition (F (1, 96) = 0.18, p = 0.67). Post hoc tests compared the ratings for Statement 5 across the three profiles and indicated a statistically lower rating for the low eye contact profile, as compared to the high eye contact profile. The analysis also revealed participants rated the high eye contact profile significantly different than the "socially validated" profile. This suggests that the adolescents perceived the speaker emitting low eye contact as though they would be less likely to get an important job, whereas the high eye contact profile

would be more likely than both the low and "socially validated" to get an important job. Additionally, post hoc tests compared the ratings for the three profiles by group. The analysis revealed that non-justice-involved youth (M = 3.49, SE = 0.16) rated the high eye contact profile significantly higher (p = 0.03) than the justice-involved youth (M = 2.97, SE = 0.16). The prompt did not have a significant impact on ratings.

Statement 6: The speaker would not have a lot of friends.

The analysis for Statement 6 (i.e., "The speaker would not have a lot of friends") revealed an overall significant effect of profile (F (2, 96) = 3.33, p = 0.04) and group (F (1, 96) = 5.13, p = 0.03) but no effect for condition (F (1, 96) = 0.34, p = 0.56). Post hoc tests compared the ratings for Statement 6 across the three profiles and did not reveal any significant differences. Additionally, post hoc tests compared the ratings for the three profiles by group. The analysis revealed that non-justice-involved youth (M = 1.09, SE = 0.19) rated the "socially validated" profile contact profile significantly lower (p = 0.02) than the justice-involved youth (M = 1.76, SE = 0.19). The prompt did not have a significant impact on ratings.

TASSK: Differences Between Groups

Researchers used an independent samples t-test to evaluate differences in TASSK scores between non-justice-involved youth (M = 16.56, SD = 2.70) and justice-involved youth (M = 17.21, SD = 3.15). Results revealed no significant difference between the two groups, t(100)= -1.11, p = 0.27. Therefore, researchers combined the two groups to conduct one 3 x 3 repeated measures ANOVA per statement to assess the impact of TASSK score (divided into three categories) on responding across the three profiles.

TASSK Differences in Categories: Both Groups Combined

The researcher conducted one 3 x 3 repeated measures ANOVA per statement to evaluate the influence of adolescents' self-assessed knowledge of social skills measured through the TASSK on their ratings across profiles (Table 2). Using the same TASSK categories as Bush et al. (2022), the researcher divided the adolescents from both groups into High (n = 43, score between 18 - 23), Moderate (n = 32, score of 16 or 17), and Low (n = 25, score of 9 - 15) categories. The ANOVAs revealed only two significant differences. Participants who scored moderately on the TASSK rated Statement 1 for the low eye contact profile significantly lower than those who scored High or Low. In other words, those with a moderate self-assessment of their social skills rated the low eye contact profile as less "normal". Similarly, the participants who scored moderately on the TASSK rated Statement 2 for the "socially validated" profile significantly lower than those who scored High or Low. Again, those with a moderate self-assessment of their own social skills knowledge rated the "socially validated" profile as a speaker they would be less likely to talk to than the other speakers.

ICU, Differences in Categories: Justice-Involved Adolescents

The researcher conducted one 2 x 3 repeated measures ANOVA per statement to measure the effect of CU traits assessed through the ICU (M = 37.08, SD = 10.02) on their ratings across profiles (Table 3). Using the criteria suggested by Kemp et al. (2021), the researcher divided the justice-involved adolescents into the categories of High (n = 22, score of 37 or above) or Low (n = 26, score of less than 37). The ANOVAs revealed only two significant differences. Participants who scored high on the ICU rated Statement 3 for the high eye contact profile significantly higher than those who scored Low. Put differently, those who had high CU traits rated the high eye contact profile as more inattentive. Additionally, the participants who scored high on the ICU rated Statement 6 for the "socially validated" profile significantly higher than those who

scored Low. In other words, those who had high CU traits perceived the speaker emitting "socially validated" eye contact as more likely to not have friends.

Discussion

Justice- and non-justice-involved youth rated a speaker who displayed high (96% of a 5 min session), "socially validated" (87.3% of a 5 min session), or low (52% of a 5 min session) amounts of eye contact on six different statements. Taken together, the results give rise to two general findings for adolescents. First, they *did* detect the different levels of eye contact in the three profiles. Second, they rated the low eye contact speaker less favorably than the speaker in the other two profiles. Specifically, they rated the low eye contact speaker as someone who looked less normal, would be someone they were less likely to talk to, inattentive, unable to sit still, and less likely to get an important job.

Overall, the prompt did not make a significant difference in their ratings. There are a couple of reasons drawing attention to the eyes of the speaker did not alter ratings. It could be that the adolescents did not attend to the instruction. Even if they read the prompt, they could have disregarded it and therefore the prompt did not have influence. Conversely, all adolescents may have attended to the speaker's eyes rendering the prompt unnecessary.

The justice and non-justice involved youth gave similar ratings for three of the statements. However, the non-justice-involved youth rated the high eye contact profile more harshly than the justice-involved youth for inattentiveness, but less harshly for getting an important job. By contrast, the justice-involved youth rated the "socially validated" profile more harshly than non-justice-involved youth for not having friends.

Unexpectedly, the level of CU traits had little impact on the ratings of the statements across profiles. It may be that attending to relevant stimuli for emotion and empathy

development requires longer periods of eye gaze versus the short duration needed to discriminate and judge another person's eye contact engagement (Dadds et al., 2104; Demetriou & Fanti, 2022). The ratings for two statements on two profiles where CU traits *did* have a significant influence (Statement 3, high eye contact; Statement 6, "socially validated") might indicate that individuals with high CU traits may have a slightly more negative perception of individuals with higher levels of eye contact.

The minimal differences between ratings for the two groups provided a surprising result given previous research (e.g., Dadds et al., 2008, 2011; Levantini et al., 2022; Gehrer et al., 2020, 2021) demonstrating impairments in eye contact for individuals involved with the justice system and/or with high CU traits. The researcher previously hypothesized the adolescents involved in the juvenile justice system would have a reduced ability to discriminate eye contact differences. Instead, the justice-involved youth *did* demonstrate the ability to discriminate the low eye contact speaker from the other two speakers and responded differently based on their perceptions. Markedly, the current study did not assess eye contact engagement; nevertheless, these findings might suggest that even slight variances in eye contact are salient to observers (Palmer et al., 2022), regardless of the respective observer's level of eye contact engagement.

Because the two groups did not significantly differ in their TASSK scores, the researcher combined the two groups for subsequent analyses. To this end, the TASSK level had no significant impact on their ratings of statements across profiles except on two statements for two profiles (Statement 1, low eye contact; Statement 2, "socially validated"). The results indicated those who scored average in their knowledge of social skills perceived those with low eye contact as less normal than those with high or low self-assessed knowledge. Furthermore, those same participants would be less likely to talk to an individual with "socially validated" eye

contact. Individuals with an average level of social skills knowledge may be more critical than those with high or low self-assessed skills when it pertains to normalcy and potential conversational partners.

The results from this study are consistent with the findings of Bush et al. (2022) in that the participants judged the speakers differently across the three different profiles. For example, both studies found a significant difference in the rating of Statement 4 (i.e., “The speaker cannot sit still”) for the low eye contact profile indicating the level of eye contact may impact the perception of other communicative behaviors. However, the researcher expected to find more significant differences between the “socially validated” and high eye contact profiles. The non-significant findings may indicate higher amounts of eye contact had less impact on the adolescents' perceptions of the speakers than young adults. In general, the lack of significant differences between the “socially validated” and high eye contact profiles may imply adolescents prefer higher amounts of eye contact than young adults. By contrast, both adolescents and young adults perceived low eye contact negatively. Another noted difference between the two studies came from justice-involved and non-justice-involved youth each rating only three statements significantly different for the low eye contact speaker as compared to the “socially validated” speaker, whereas the young adults from Bush et al. (2022) rated all six statements significantly different. This finding could indicate the amount of eye contact impacts adolescents' perception of some aspects of social interactions but not others.

Overall, the findings from both studies support the idea that the perception of eye contact could impact social inclusion and acceptance. Therefore, those with low eye contact are at greater risk and this emphasizes the need for “normative” data regarding eye gaze. This could be especially detrimental for individuals already at high risk for social exclusion such as justice-

involved youth. To further investigate the impact of eye contact on the emotional development and social inclusion of justice-involved youth, our lab plans to use an eye tracker to evaluate eye contact engagement while assessing social skills, emotional development, and CU traits.

The current study had a few notable limitations. The sample size for each of the four groups (i.e., non-justice-involved youth who did/ did not receive a prompt and justice-involved youth who did/ did not receive a prompt) used to evaluate a prompt to attend to the speaker's eyes, had fewer participants than preferred. However, the total number of participants (i.e., non-justice-involved and justice-involved youth) qualified as an adequate sample size. Despite the small sample sizes for the prompt analysis, the ANOVAs still detected significant differences for three statements. Larger sample sizes in future research may have the statistical power to detect smaller effects.

Additionally, the statements used to measure perception did not undergo a typical validation process. However, when Bush et al. (2022) created the videos and corresponding statements, they selected statements representing components of successful social interactions. Therefore, the statements offer a socially relevant means to evaluate eye contact perception. Also, the questions on the TASSK assessment may not have accurately assessed the adolescent's social skills knowledge. Some of the questions presented a situation in which one of the answer options included getting the help of an adult. Although the TASSK considered this a wrong answer, many adolescents receive training to seek the help of an adult to handle bullies and other hard social situations. Incorrect scores on these questions may have influenced the validity of the assessment and subsequent analyses.

As mentioned before, the researcher did not include measures of eye contact in the current study. This limits conjecture regarding eye contact impairment and the ability to

discriminate others' level of eye contact. However, previous research provides some empirical support to make inferences that justice-involved youth may have impaired eye gaze, especially those with high CU traits. Future researchers should include this component when evaluating social validity for the perception of eye gaze and eye contact impairment for justice-involved youth.

Furthermore, the justice-involved youth who participated in this study may not be representative of all justice-involved youth. Of note, they receive mandated therapeutic services that most justice-involved youth do not receive. Likewise, adolescents who commit sexual offenses may demonstrate marked differences from those committing non-sexual offenses (e.g., theft, assault, etc.). These offense differences may also represent individuals with sub-cultural differences that may impact eye contact and perception (e.g., gang affiliation). Researchers should include various populations such as those who do not receive therapeutic services in future studies.

Additionally, the current study used video models to simulate eye contact during a recorded conversation. It is possible that varying amounts of eye contact with an in-person conversational partner may affect perception more strongly (Hietanen et al., 2020; Noah et al., 2020). Likewise, a video model or live speaker within the age range of adolescents (i.e., a peer) may also impact perception. Regardless, the results of Bush et al. (2022) and the current study suggest eye contact is discriminable and individuals make judgments based on their perception. Future researchers could investigate what impact these variables may have on adolescents' perception of eye contact by creating similar videos with an adolescent speaker or conducting in-vivo conversations where eye contact is systematically varied. To that end, videos with a shorter

duration may give insight into how quickly perceptions of a speaker are formed when eye contact varies.

The current study provided additional support for the concept that individuals can detect varying amounts of eye contact and may judge someone based on their perceptions. The results from this study reveal at least two areas for future research. From the aspect of the eye contact impaired individual, increasing levels of eye gaze may result in a higher likelihood of social inclusion. For instance, based on the ratings of profiles for Statement 2 (i.e., "You would talk to the speaker") adolescents may be more likely to identify those with higher amounts of eye contact as potential conversational partners. Likewise, it may be advantageous for researchers to evaluate training for individuals to be more tolerant of those who have impaired eye contact, due to the harsher evaluations of the low eye contact speaker. As noted previously, teaching tolerance may not provide the eye contact impaired individual with the neural activations required in the development of the social brain; however, it could help decrease social exclusion which could enhance positive life outcomes.

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Table 1

Within-subject 2 x 2 x 3 ANOVA Results by Statement

Statement	Profiles: Mean Rating		
	HEC vs. SV	SV vs. LEC	HEC vs. LEC
Looks normal	4.03 vs. 3.99	3.99 vs. 3.39*	4.03 vs. 3.39*
Would talk to speaker	3.10 vs. 3.02	3.02 vs. 2.93	3.10 vs. 2.66*
Inattentive	1.43 vs. 1.43	1.43 vs. 2.42*	1.43 vs. 2.42*
Cannot sit still	1.55 vs. 2.01	2.01 vs. 2.54*	1.55 vs. 2.54*
Would get an important job	3.23 vs. 2.90	2.90 vs. 2.61	3.23 vs. 2.61*
Would not have a lot of friends	1.15 vs. 1.43	1.43 vs. 1.52	1.15 vs. 1.52

Note: n = 100. The anchoring for the Likert scale was *not at all true* (0) to *very true* (5). HEC = high eye contact profile (96%), SV = "Socially Validated" (87.3%), LEC = low eye contact (52%). *$p < .05$.

Table 2

Between-subject results, 3 x 3 repeated measures ANOVA: TASSK

Statement	Profile	TASSK Category		
		High	Moderate	Low
Looks normal	HEC	4.16	3.72	4.19
	SV	4.19	3.28	4.28
	LEC	3.61	3.12*	3.53
Would talk to speaker	HEC	3.28	2.68	3.22
	SV	3.27	2.36*	3.31
	LEC	2.84	2.48	2.84
Inattentive	HEC	1.28	1.40	1.41
	SV	1.54	1.48	1.07
	LEC	2.23	2.36	2.34
Cannot sit still	HEC	1.58	1.76	1.34
	SV	2.14	2.04	1.75
	LEC	2.58	2.76	2.13
Would not get an important job	HEC	3.37	2.92	3.22
	SV	2.98	2.48	3.13
	LEC	2.67	2.40	2.84
Would not have a lot of friends	HEC	0.93	1.16	1.41
	SV	1.16	1.52	1.50
	LEC	1.44	1.44	1.47

Note: n = 100. The anchoring for the Likert scale was *not at all true* (0) to *very true* (5). TASSK = Test of Adolescent Social Skills Knowledge. High = individuals who scored High on the TASSK (*n* = 43; 18 - 23). Moderate = individuals who scored Moderate on the TASSK (*n* = 32; 16 or 17). Low = individuals who scored Low on the TASSK (*n* = 25; 9 - 15). HEC = high eye contact profile (96%), SV = "Socially Validated" (87.3%), LEC = low eye contact (52%). *$p <$ .05.

Table 3

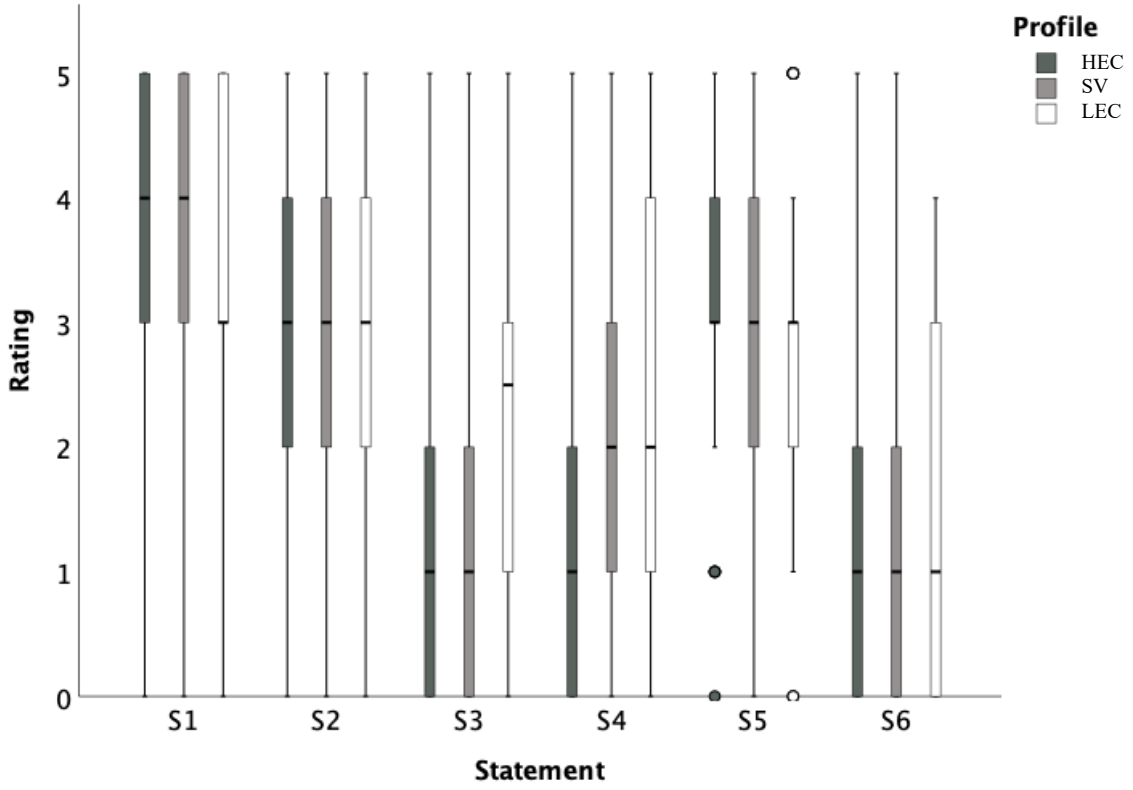
Between-subject results, 2 x 3 repeated measures ANOVA: ICU, Justice-Involved Adolescents

Statement		ICU Category	
	Profile	High	Low
Looks normal	HEC	4.18	4.31
	SV	4.05	4.04
	LEC	3.41	3.58
Would talk to speaker	HEC	3.32	3.89
	SV	2.91	3.31
	LEC	2.86	3.00
Inattentive	HEC	1.59*	0.65
	SV	1.36	1.00
	LEC	1.91	2.54
Cannot sit still	HEC	1.14	1.85
	SV	1.91	1.85
	LEC	2.27	2.92
Would not get an important job	HEC	3.46	3.42
	SV	3.05	3.19
	LEC	2.96	2.62
Would not have a lot of friends	HEC	1.18	0.73
	SV	1.50*	0.69
	LEC	1.27	1.39

Note: n = 48. The anchoring for the Likert scale was *not at all true* (0) to *very true* (5). High = individuals who scored High on the Inventory of Callous Unemotional (ICU) traits assessment (*n* = 22; 37 or above). Low = individuals who scored Low on the ICU assessment (*n* = 26; less than 37). HEC = high eye contact profile (96%), SV = "Socially Validated" (87.3%), LEC = low eye contact (52%). *$p < .05$, found in post-hoc tests.

Figure 1

Box Plot of Rating by Statement by Profile for All Adolescents



Note: *N* = 100. The anchoring for the Likert scale was *not at all true* (0) to *very true* (5). HEC = high eye contact profile (96%), SV = "Socially Validated" (87.3%), LEC = low eye contact (52%). S1 = The speaker looks normal. S2 = You would talk to the speaker. S3 = The speaker is inattentive. S4 = The speaker cannot sit still. S5 = The speaker would not get an important job. S6 = The speaker would not have a lot of friends.