Using an Elicited Orienting Response and Respondent Conditioning to Increase Eye Contact in Response to a Name Call in Children with Autism

by

Nicole Adriaenssens

A thesis submitted to the College of Psychology of
Florida Institute of Technology
in partial fulfillment of the requirements
for the degree of

Masters of Science
in
Applied Behavior Analysis and Organizational Behavior Management

Melbourne, Florida
July, 2019

We the undersigned committee hereby approve the attached thesis, "Using an Elicited Orienting Response and Respondent Conditioning to Increase Eye Contact in Response to a Name Call in Children with Autism" by Nicole Adriaenssens.

A. Celeste Harvey, Ph.D., BCBA-D
Associate Professor
School of Behavior Analysis
Major Advisor

Corina Jimenez-Gomez, Ph.D., BCBA-D
Research Assistant Professor
School of Behavior Analysis

Theodore Petersen, Ph.D.
Associate Professor
School of Arts and Communication

Lisa Steelman, Ph. D.
Professor and Dean
College of Psychology and Liberal Arts

Abstract

Using an Elicited Orienting Response and Respondent Conditioning to Increase Eye Contact in Response to a Name Call in Children with Autism

Author: Nicole Adriaenssens

Advisor: A. Celeste Harvey, Ph.D., BCBA-D

One of the earliest and most noticeable characteristics of children with Autism Spectrum Disorder (ASD) is impaired eye contact. Difficulty with making eye contact presents concerns for children regarding academic, social, and safety skills—for instance, failing to respond to a teacher calling a child's name to give instructions, looking at a peer during play, or orienting toward an adult speaker warning the child of a risky situation. Currently published research on increasing responding to name with eye contact has primarily involved separate and combined procedures such as physical prompting, visual prompting, differential reinforcement, and overcorrection. The current study evaluated the effects of an auditory orienting response using a variety of short, non-social sounds within acceptable levels of auditory perception to elicit eye contact. Non-social sounds are those that are made by an inanimate object, such as a phone ringing or a recording of a car horn. When eye contact occurred following presentation of the non-social auditory stimulus, the experimenter used respondent conditioning to pair the presentation of the participant's name with a highly preferred stimulus. This procedure was used as a supplement to differential reinforcement to increase eye contact in four young children with ASD. Results suggest the current procedure may be an effective way to teach young children with ASD to make eye contact in response to a name call.

Table of Contents

List of Figures

Acknowledgement

I would like to thank my advisor Dr. Celeste Harvey for her continued guidance and communication throughout this experience. I would like to thank my committee members, Dr. Petersen and Dr. Jimenez-Gomez for their support and feedback. A big thank you to my fellow students Cheyenne Dong and Tiara Rahadian Putri for their assistance with data collection. I would also like to thank all my loved ones for their unwavering support and encouragement. Lastly, I am grateful for the families and clinicians of the participants, because of them this study was able to be completed.

Dedication

This paper is dedicated to my father, without him my many accomplishments would not have been possible. When asked who my hero was as a child, my answer was always "my dad", and after decades my answer has stayed the same. Thank you for pushing me to challenge myself, thank you for all of your wise words, thank you for not letting me give up when the obstacles in my path seemed impossible to overcome. Thank you for believing in me so much that I now believe in myself.

Chapter 1
Introduction

The most current estimate of the prevalence of Autism Spectrum Disorder (ASD) in the United States is approximately 1 in every 59 children (CDC, 2018). Early identification of ASD is a critical step in accessing treatment, e.g. early intensive behavioral intervention, to mitigate many of the problems affected individuals experience across their lifespan—including impaired communication, problem behavior, repetitive or restrictive interests, and social behavior. One of the earliest noticeable characteristics of children with Autism Spectrum Disorder (ASD) involves impairment in eye contact during social interactions (APA, 2013; Kanner, 1943; Jones, Carr, & Klin, 2008; Barbaro & Dissanayake, 2013; Kleinke, 1986; Jones & Klin, 2013a). Individuals with ASD typically exhibit difficulties with social communication, and gaze behavior is either absent or impaired at various levels, such as eye contact, face gaze, gaze following, and joint attention. Eye contact is defined as the movement of a person's head and eyes so as to make direct contact with the eyes of another person. Eye contact is crucial during social communication, and typically developing infants learn during their first year of life that “looking” behaviors of others convey significant information (Carbone, O'Brien, Sweeney-Kerwin, & Albert, 2013).

Since Kanner’s first reports (1943, 1944) of atypical eye contact in children with ASD, the absence of eye contact has been reported and discussed across many clinical and experimental settings. Home video analysis of infants who were later diagnosed with ASD has revealed that atypical patterns of eye contact can be observed within the first year of life, well before the typical age of diagnosis (Jones & Klin, 2013a). Jones and Klin discovered that infants later diagnosed with ASD show a decline in fixed gaze toward a social partner’s eyes as early as two to six months of age. Based on clinical significance, eye contact is currently included in standardized diagnostic criteria such as DSM-V for the diagnosis of ASD (APA, 2013). The DSM-V specifies “marked impairment in the use of multiple nonverbal behaviors (e.g., eye-to-eye gaze) to regulate social interaction and communication” (American Psychiatric Association, 2013). Barbaro and Dissanayake (2013) conducted a study to determine the most discriminating and predictive markers of ASD and found that failure to respond to their name was predicative of ASD at 18 and 24 months of age.

Jones, Carr, and Klin (2008) noted that the strongest markers for early diagnosis of ASD focused on atypical engagement with other people. These markers include reduced interaction with and looking at others, failure to respond to their names, and diminished eye contact with others. Jones, Carr, and Klin (2008) found that toddlers with ASD failed to demonstrate preferential fixation to the eyes of approaching adults and preferred instead to look at the mouth region, unlike typically developing and developmentally matched control toddlers. If the child's fixes his or her gaze on the wrong environment cues, he or she may fail to respond to relevant social and behavioral cues, such as eye contact during social interactions. Overselectivity to one part of the face, such as the mouth, nose, or ears would interfere with face recognition and may interfere with the development of sensitivity to social reinforcement and socially appropriate interactions (Novak & Pelaez, 2011).

Eye contact is a prerequisite in initiating and responding to functional social interactions, learning about the social attention of others, and understanding the communicative and emotional significance of eye gaze (Jones, Carr, & Klin, 2008). Eye contact represents an important signal of another's interest and attention, and serves to establish a communicative context (Kleinke, 1986). Charman, Drew, Baird, and Baird (2003) conducted a correlational and longitudinal study of eye contact and joint attention in toddlers with ASD. The authors concluded that the lack of eye contact correlated with a higher degree of social disability and was also linked to cognitive and language deficits at 42 months of age. Charman et al. (2003) further posited that an ability to make eye contact and to demonstrate joint attention represents a pivotal skill in early childhood, leading to higher academic and social achievement. Other research suggests that eye contact and joint attention function as prelinguistic skills that are highly predictive of the rate of language acquisition, and thus warrant further attention early in a child's development (Carbone, O'Brien, Sweeney-Kerwin, and Albert, 2013; Kleinke, 1986). Many teaching procedures require the instructor to gain eye contact from a child before delivering an instructional demand. For instance, listener responding targets may specify that a child orients to the speaker or responds to hearing his or her name as preliminary teaching steps (Sundberg, 2008). Gaining eye contact is an important target for compliance training with simple instructions and involves teaching the child to orient toward the instructor first, and later toward teaching materials, or other speakers.

Orienting to Social and Non-Social Auditory Stimuli

Typically developing infants begin to respond to social stimuli at a very young age; however, one of the earliest markers for ASD is a failure to orient to social stimuli (American Psychiatric Association, 2013; Barbaro and Dissanayake, 2013; Jones, Carr, and Klin, 2008; Jones and Klin, 2013a). For example, retrospective studies of home videotapes revealed that 1-yr-old children who were later diagnosed with ASD attended less to people, failed to respond to their name, and showed impairments in joint attention when compared to 1-yr-old children with and without other disabilities (Osterling & Dawson, 1994; Osterling, Dawson, & Munson, 2002). A study by Dawson (2004) investigated whether children with ASD orient to social auditory stimuli less often than to non-social auditory stimuli. The term “social orienting” was created by Dawson and colleagues to describe the failure of children with ASD to orient to naturally occurring social stimuli in the environment. Dawson (2004) examined social orienting among a group of children that included children with ASD, children with developmental delays (no ASD diagnosis), and typically developing children. In this study, various social and non-social stimuli were presented and the children’s orientation towards the stimulus was recorded.

The purpose of the study done by Dawson (2004) was to replicate and extend a previous study by Dawson, Meltzoff, Osterling, Rinaldi, and Brown (1998) which also examined social orienting with children with ASD, Down Syndrome, and typical development. Results from the study by Dawson et al. (1998) indicated that children with ASD failed more frequently to orient to both social and nonsocial stimuli, when compared to children with Down Syndrome and typically developing children, and that this failure to attend to stimuli was more severe for social stimuli. The experimenters also found that children with ASD were more impaired in their joint attention ability and that this impairment was strongly correlated with their social orienting ability. Dawson (2004) noted that the

1998 study by Dawson et al. was limited by the small number of stimuli used (i.e., name calling and hand clapping as the social stimuli, and a rattle and a musical toy for the non-social stimuli). The study was also limited by the possibility that the social stimuli were more familiar to the children than the non-social stimuli that were tested (Dawson, 2004). The replication study by Dawson (2004) extended the Dawson 1998 study by using a larger number of stimuli and using social and non-social stimuli that were equally familiar to the children (according to parental ratings of the stimuli).

During the study by Dawson (2004) the child sat across from one experimenter while playing with a chosen toy that was “mildly interesting.” Once the child engaged in play, the second experimenter delivered the auditory stimuli. The four social stimuli included sounds used by the experimenter’s voice and body; (a) humming a neutral tone, (b) calling the child’s name, (c) snapping fingers, and (d) patting hands on thighs. The four non-social stimuli included sounds of inanimate objects; (a) a timer beeping, (b) a phone ringing, (c) a whistle blowing, and (d) a tape recording of a car horn. Each stimulus was delivered three times with a 1-s inter-stimulus interval and a decibel meter placed next to the child to measure to ensure that the social and nonsocial stimuli were the same volume. The stimuli were delivered only when the child looked away from the second experimenter.

Stimulus order and location (i.e., behind child, in front of child, 30 degrees to the left, and 30 degrees to the right) was counterbalanced across all participants.

Orienting was measured and was defined as turning the head and/or eyes toward an auditory stimulus. If the child turned his or her eyes and/or head toward the stimulus, the response was counted as correct. Results indicated that children with ASD failed more frequently to orient to all stimuli when compared to children with delayed and typical development and that this impairment was more severe for social stimuli. Children with ASD showed a severe impairment for orienting to social stimuli compared to children without ASD. When individual stimuli were examined, it was discovered that children with ASD oriented significantly less often than children without ASD to all four social auditory stimuli. The authors concluded that the results provided further evidence of deficits in social orienting in children with ASD (American Psychiatric Association, 2013; Barbaro and Dissanayake, 2013; Jones, Carr, and Klin, 2008; Jones and Klin, 2013a Osterling & Dawson, 1994; Osterling, Dawson, & Munson, 2002). In addition, Dawson (2004) noted that 75.5% of children with ASD and 81.5% of children without ASD were correctly classified, meaning they were correctly placed in the category of either having ASD or not by only looking at the social orienting results for each child.

The study by Dawson (2004) revealed that pre-school aged children with ASD showed significant impairment with regards to social orienting. Orienting responses (OR) may be described as reflexive, or untrained responses to stimuli within an organism's environment. For instance, in infants and toddlers with neurotypical development, visual and auditory responses occur without prior training (Friesen & Kingstone, 1998). Infants instinctively look toward their mothers' faces within hours of birth, and a loud sound makes a young child jump. Information from our senses guides us to respond in ways that promote our safety and survival. Although children with ASD typically show atypical orienting responses to social stimuli (Klin, Schultz, & Jones, 2015) eye gaze responses may be taught via respondent and operant conditioning procedures (see Senju, Tojo, Dairoku, & Hasegawa, 2004). To better elucidate the mechanisms involved in respondent and operant conditioning, a brief overview of current methods of eliciting and evoking orienting responses follows.

Unconditioned reflexes occur in respondent conditioning and are defined as a reliable relation between a stimulus and a change in behavior elicited by the stimulus (Ahearn, Parry-Cruwys, Toran, & MacDonald, 2015). Unconditioned reflexes can also be involved in learning. Stimuli that reliably come before or predict the delivery of food can elicit salivation. In the famous example of Pavlov's (1928) dogs, if a bell is rung reliably before food is delivered, salivation will later be elicited by the sound of the bell. Before the bell and food pairings, the bell serves as a neutral stimulus that does not elicit salivation. Following repeated pairings, however, the bell becomes a conditioned stimulus (CS) and elicits salivation. Thereby, a new conditioned reflex (i.e., salivation elicited by the bell) is established. Conditioned reflexes develop when specific events come to reliably predict that an unconditioned stimulus (e.g., presentation of food) will follow (Ahearn, Parry-Cruwys, Toran, & MacDonald, 2015). One unconditioned reflex is the orienting response (OR). The discovery that the OR plays an important role in conditioning originates from Pavlov and Anrep (1928). Pavlov described the OR as a reflex that alerts animals to changes in their environment, bringing about the immediate response of orienting towards these changes and the response of investigating these changes (Pavlov & Andrep, 1928).

Buzsáki (1982) further expounded on the ideas of Pavlov and Andrep (1928), that when an organism's OR to a stimulus initially involves an elicited operation, repeated presentation of a reinforcer following the presentation of a neutral stimulus of importance to the organism leads to the initially neutral stimulus becoming a conditioned stimulus (CS). During this process of conditioning, the organism orients toward the CS. The presentation of the CS therefore signals not only the probability of reinforcement, but also guides the organism to the location where reinforcement is most likely to be delivered. Experimental evidence shows that the development and maintenance of conditioned ORs occur both in respondent and operant conditioning.

Kupalov (1969) studied the effects of training involving CS-US pairings in dogs. He repeatedly observed that during the course of training, dogs showed an increasing tendency for orienting toward the CS source. Responses consisted of head turning toward the CS. Although similar responses were observed in some dogs prior to conditioning, the incidence of orienting towards the CS was considerably higher during the course of conditioning. A series of experiments by Grastyán and Vereczkei (1974) investigated ORs with cats as subjects. The authors also suggested that the OR was a learned consequence of reinforcement in the form of a food reward. Grastyán and Vereczkei (1974) pointed to the adaptive function of the signal-directed OR: in nature, where approach to the signal results in food reward. Conditioning trials provided the opportunity for the subjects to discover the predictors of the food reward. Any stimulus changes or situation that has already been correlated with food will upon subsequent occurrence trigger food-searching, provided that the animal is hungry (Grastyán & Vereczkei, 1974).

To extrapolate the findings regarding orienting responses to humans, Koch (1967) conducted an experiment to find out how conditioned ORs develop when different kinds of putative reinforcers were used. In two-month old infants, Koch conditioned head-turning to a sound and reinforced the head-turning response by showing an attractive toy. During the experiment, researchers placed a child in a crib with a device that measured head-turning. The experimenter conditioned head-turning to a toy emitting a sound (CS), and then reinforced the CR of head-turning with different social and non-social reinforcers. Ten sessions were run for each type of reinforcer for each child, and each session included ten paired presentations of the conditioned stimulus (i.e., the sound) and the reinforcing stimulus (i.e., the toy). Results indicated that after pairing complex reinforcing stimuli—the novel toys and experimenters rocking and coddling the infant—yielded increases in the conditioned orienting responses (see Prokasy, 1977 and Zuromski, 1975 for additional examples of conditioned orienting responses).

According to Cook et. al. (2017) and Mundy (2003), social interactions such as eye contact do not appear to be inherently reinforcing for children with ASD. Interestingly, a study by Goldberg et al. (2017) found no difference in the reinforcing value of social stimuli between boys with high-functioning ASD and typically developing boys of the same age. Evidence also suggests that children with ASD respond differently to social stimuli when compared to typically developing children. According to Ahearn, Parry-Cruwys, Toran, and MacDonald (2015), social stimuli, such as the eyes and face, do not evoke the same responding in children with ASD when compared to their typically developing peers due to altered stimulus salience. The behavior of children with ASD differs because their responding is controlled by aspects of their environment that are not the same as aspects that control the behavior of typically developing children. Learning differs when it is driven by different aspects of our environment. This difference in learning is what produces the behavioral characteristics of ASD, such as lack of social orienting, lack of eye contact, and lack of responding to name (Ahearn, Parry-Cruwys, Toran, & MacDonald, 2015).

Due to differences in learning, children with ASD may need to be explicitly taught how to make eye contact with a communicative partner. Several researchers have developed protocols for increasing eye contact behavior, based on applied behavior analytic principles, with mixed results (Carbone, O'Brien, Sweeney-Kerwin, and Albert, 2013; Cook et al., 2017; Foxx, 1977; Hall, Maynes, & Reiss, 2009; Miller, 2017; Tetreault & Lerman, 2010). Typical procedures involve a variety of prompting methods, primarily including physical, visual, or verbal prompts, and the systematic use of differential reinforcement to increase eye contact behavior.

Prompting to Teach Eye Contact

There is a substantial amount of literature on the prevalence in a lack of responding to a name call in young children with ASD, but there are very few studies on procedures to increase responding to a name call with eye contact. However, there are several studies on procedures used to increase eye contact in children with ASD. In one of the earliest studies on improving eye contact, Foxx (1977) used a combination of physical prompting, with edibles and social praise to improve eye contact with a procedure called “functional movement training.” Participants in the study included one 8-yr-old child with ASD and two children with Down Syndrome, six and eight years old. In this study, the investigator said, “look at me.” If the child did not respond with eye contact within 5 s, the therapist said “______ (child’s name), you didn’t look at me,” in a stern voice and implemented functional movement training as an overcorrection procedure. During functional movement training, the experimenter delivered a verbal prompt (e.g., “head up”). If the child failed to comply within 1 s of the instruction, the experimenter physically guided the child’s head in the requested direction. The child was required to hold the position for 15s. After approximately 20 s, a new trial started. If the initial instruction, “look at me,” resulted in the avoidance response of eye contact within 5s, praise and an edible were delivered, and no functional movement training was provided (Foxx, 1977). The avoidance response was that the children responded with eye contact to avoid functional movement training. Results indicated that functional movement training was an effective method for increasing eye contact for all three children. Hall, Maynes, and Reiss (2009) found similar results in a systematic replication of Foxx’s (1977) study for increasing eye contact. A potential limitation of the study was that it was difficult to determine the separate effects of negative and positive reinforcement. One interpretation of this study is that participants avoided the functional movement training component by establishing eye contact via negative reinforcement and received positive reinforcement for compliance with instructions to make eye contact within 5 s of a verbal prompt (Foxx, 1977). Foxx also noted that the procedure should be used as a last resort only when positive procedures have proven to be ineffective, due to the use of aversive control to establish improved eye contact. The use of physical prompts should be used as a very last resort as it presents potential ethical and safety issues (e.g., …).

It is a common observation in clinical settings and natural settings to see the use of verbal prompting to teach children with ASD to respond to their name. The parent or therapist of a child might verbally prompt the child several times by repeating the child's name in order to get them to respond to their name. However, very few published studies exist on the use of verbal prompting to teach children to respond to their name. A study by Hamlet, Axelrod, and Kuerschner (1984) found that prompted eye contact using verbal prompting resulted increases in eye contact and in levels of compliance that were two to three times higher than baseline levels. During the demanded eye contact condition, the teacher called the student's name and paused for 2 s. If the student made eye contact within 2 s, the teacher provided an instruction. If the student did not make eye contact within 2 s, the teacher demanded eye contact by saying, "(Name), look at me" using a moderately firm tone of voice. If the child made eye contact, the experimenter repeated the instruction again. Higher levels of compliance occurred in the demanded eye contact condition compared to baseline phases, when eye contact was not required. Although the results demonstrated that demanded eye contact is an effective antecedent for increasing compliance to instruction, this approach has a major drawback. Demanded eye contact was always followed by a demand and not reinforcement, which is a problem because eye contact following a name call may become aversive to the students if it always followed by a demand and this skill may not maintain.

Differential Reinforcement to Teach Eye Contact

One of the most frequently used interventions used by behavior analysts to increase eye contact in children with ASD is the use of differential reinforcement alone or in combination with vocal prompts, tangible prompts, or gestural prompts. Several studies have investigated teaching eye contact using differential reinforcement (Cook et al., 2017; Matson et al., 1988; Ninci et al., 2013; Thomas, Lafasakis, & Sturmey, 2010). Differential reinforcement is defined as reinforcing only responses within a response class that meet some criteria and placing all other responses on extinction (Cooper, Heron, and Heward, 2007). Carbone, O'Brien, Sweeney-Kerwin, and Albert (2013) conditioned eye contact during mand training for an eight-yr-old boy with ASD. The experimenters used an AB design to determine if there was a correlation between the independent variable—differential reinforcement, and the dependent variable--percentage of mands with eye contact.

During the baseline condition, all of the participant's vocal mands were reinforced by the therapist immediately delivering the requested item or activity. During the differential reinforcement condition, if the participant manded for an item or activity and eye contact occurred prior to or in addition to the vocal mand, the item or activity was immediately delivered. If the participant manded without eye contact, the therapist implemented extinction, withholding the requested item or activity. Extinction continued until the participant engaged in a vocal mand for the item or activity with eye contact. The results from this study suggest that differential reinforcement alone, without the use of prompts, may be effective in increasing eye contact in children with ASD. Some limitations of the study was that it involved an AB design, with insufficient experimental control over the eye contact with manding response and the study included only one participant.

Cook et al. (2017) evaluated the effects of a sequential model for increasing eye contact in children with ASD by using differential reinforcement. The study included 21 participants and sequential model included measuring percentage of trials with eye contact across the following phases: (a) contingent praise for eye contact, (b) contingent edible plus praise, (c) edible prompt plus contingent edible and praise, (d) contingent video and praise, (e) schedule thinning, and (f) maintenance evaluation for up to two years. The experimenters implemented each phase for a minimum of five session and continued to conduct sessions in a specific phase if there was an increasing trend in eye contact. All participants started with the contingent praise phase, and they progressed through the phases based on their responding. During the contingent praise phase, the therapist called the participant's name. If the participant provided eye contact within 3 s, the therapist provided verbal praise. The contingent edible and contingent video phase were identical to the contingent praise phase, except that a highly preferred video or edible was provided for correct responding in addition to praise. During the edible prompt phase, the therapist said the participant's name while briefly holding the preferred edible item in front of the child and then moved the item to the side of the therapist's face. The preferred edible plus praise was delivered for correct responding. Results indicated that the sequential model increased eye contact for 20 participants. For 16 participants, praise alone was insufficient to produce increases in eye contact, but high levels of eye contact maintained with these participants when schedules of intermittent edibles or video were used in combination with praise. During the maintenance evaluation, all but one participant maintained correct responding at or above 80%.

Establishing Social Stimuli as Reinforcers

Cook et al. (2017) found that praise alone was insufficient to produce increases in eye contact, in other words, the social auditory stimulus of praise did not appear to function as a reinforcer. According to past research (Buzsáki, 1982;

Kupalov, 1969; Grastyán and Vereczkei, 1974; Koch,1967) orienting responses are under control of conditioned reinforcers and they are able to be conditioned. Stimuli can be conditioned by using either stimulus-stimulus pairing or response-stimulus pairing. Several researchers have suggested that response-stimulus pairing is more successful at establishing social stimuli as reinforcers when compared to stimulus-stimulus pairing (Beus, 2014; Dozier et al., 2012; Rodriguez & Gutierrez, 2017; Rodriguez, 2013). Stimulus-stimulus pairing is when a previously neutral stimulus (e.g., praise) is paired with an unconditioned stimulus (e.g., food). Response-stimulus pairing is when a previously neutral stimulus is paired with an unconditioned reinforcer contingent on a response.

Dozier et al. (2012) investigated stimulus pairing and response-stimulus pairing to determine which procedure was more effective at conditioning social praise as a reinforcer for twelve adults and children with intellectual disabilities. Both procedures involved pairing previously neutral praise statements with preferred edible items to determine their effectiveness in establishing praise as a reinforcer. Dozier et al. (2012) found that after stimulus-stimulus pairing, praise did not function as a reinforcer for any of the participants. Results also indicated that after the experimenters implemented a response-stimulus pairing procedure, responding increased and maintained for half of participants when praise alone was used and praise was shown to be an effective reinforcer for additional target responses. Dozier et al. concluded that response-stimulus pairing may be a useful procedure to condition praise as a reinforcer when compared to stimulus-stimulus pairing.

The current study used response-stimulus pairing and investigated a novel method for teaching children with ASD to respond with eye contact following a name call. The current study did not use any visual, verbal, or physical prompts. Instead it used non-social auditory stimuli, in the form of the presentation of short, non-social sounds, to elicit an orienting response to evoke eye contact. Then the experimenter used response-stimulus pairing to pair a preferred tangible item with the participant's name. After the pairing procedure, the experimenter then tested responding to name using differential reinforcement only with the only antecedent being the calling of the participant's name.

Chapter 2
Method

Participants

The participants included four children, three boys and one girl; Kevin, Seth, Lily, and Adam. All participants were between the ages of three and seven with a primary diagnosis of ASD. Kevin was three years old at the time of the study and spoke using one to two-words. He was enrolled in early intervention services for 30 hr per week at a university-based treatment facility. Seth was a four-year-old who also spoke using one to two-words and was also enrolled in early intervention services for 30 hr per week at a university-based treatment facility. Lily was a high functioning five-year-old who spoke using complete sentences. At the time of the study she was being home-schooled and was not receiving behavior analytic services. Lastly, Adam was a seven-year-old who spoke using one to two words. Adam was enrolled in a school/clinic-based behavior analytic treatment facility for 30 hr per week.

Inclusionary criteria included a primary diagnosis of ASD, reports of low levels of eye contact, and low levels of responding to their names when called. Exclusionary criteria included children with known hearing loss, recurring ear infections, and high levels of problem behavior. Problem behavior that would exclude a participant included high amounts of property destruction, aggression, or self-injurious behavior. Exclusionary criteria also included correct responding above 60% of trials in the baseline condition.

Settings and Materials

All sessions were conducted at a university-based treatment facility in an individual therapy room. The dimensions of the individual therapy rooms were 2.4 x 2.4 m and contained a table, two chairs, and a one-way mirror. A video camera was positioned in one corner of the room, aimed toward the participant and experimenter. Materials included moderately preferred toys; however, tablets and noisy toys that would potentially interfere with listening were excluded. Materials included highly preferred tangible items, a data sheet to record responses, a timer, and a phone or recording device. All tangibles were kept out of sight from the participant except when being delivered by the experimenter. Sessions lasted between 15 to 45 min in duration.

Response Measurement

Eye contact was defined as movement of the participant's head and eyes to make direct eye contact with the eyes of the experimenter. The auditory stimulus was between 60 to 80 dB, and within the range of 2,000 to 5,000 Hz, an optimal, safe range for participants (CDC, 2018; U.S. Department of Health and Human Services, 2017). Eye contact responses of any duration were counted as correct. A correct response was defined as eye contact with the experimenter occurring within 5 s of the auditory stimulus presentation. An incorrect response was defined as no eye contact occurring within 5 s following the presentation of the auditory stimulus. The dependent measure in this study included the percentage of correct eye contact responses.

Interobserver Agreement and Treatment Integrity

All interobserver agreement (IOA) data were collected either in vivo or during observations of recorded sessions. The trial-by-trial IOA method was used to compare data scored by both observers to compute agreement versus disagreement for orienting responses. IOA was computed for 34% of the total number of sessions by calculating agreements divided by agreements plus disagreements, multiplied by 100 to convert to a percentage. IOA was 100% during all observed sessions across all participants.

Treatment integrity measurement was scored for 34% of sessions by a second observer. The second observer scored the presence or absence of the required components of the intervention, based on a checklist, seen in Appendix A. Integrity measures were calculated by dividing agreements and disagreements, multiplied by 100 to yield a percentage. Treatment integrity was 99% (range: 75 to 100%) during all observed sessions across all participants.

Social Validity

The experimenter created a brief social validity survey for families of the participants in the study, as well as other implementers of the procedure. Questions were developed based on the effectiveness of the study, feasibility of the intervention, and likelihood of continuing to use the procedure in the future (see Appendices B and C).

Design and Procedure

Design. The present study included a delayed multiple-baseline across participants design, with embedded baseline probes (DR only) during the treatment phase. Two participants acquired the skill during the DR-only baseline phase and withdrew from the study. Kevin and Seth were run in a concurrent multiple baseline across participants, and Lily and Adam were run in a concurrent multiple baseline. Following the study, the investigator also conducted generalization probes with a novel interventionist and in a novel setting to ensure transfer of stimulus control. Maintenance probes were conducted two weeks after the participant met mastery criteria.

Assessments. Prior to the study, a Multiple Stimulus Without Replacement (MSWO) preference assessment was conducted to identify each participant's highest preferred edible or tangible item (DeLeon & Iwata, 1996). An array of six items was used in the assessment, and items selected as highest preferred were used as putative reinforcers. Adam and Kevin, only selected from non-edible tangible items, i.e. toys and electronic devices, while Seth and Lily selected from edible preferences.

An auditory stimulus assessment was also conducted prior to the start of the study. During this assessment, 10 different sounds were played, each with a volume between 60 to 80 dB and 2,000 to 5,000 Hz, for approximately 2s. For reference, some examples of common sounds that are 80 decibels include a vacuum cleaner from 3 m away and a garbage disposal from 1 m away. Each sound was played once while the participant was engaged in play with moderately preferred toys to assess whether the sound elicited a looking response from the participant. Sounds that elicited a looking response from the participants were included in the treatment phase. The number of sounds used for each participant ranged from three to six different sounds.

Baseline. During the baseline phase, the experimenter sat facing the participant from approximately .5 to 1 m away and said the participant's name while the participant played with moderately preferred toys. If the participant made eye contact within 5 s of their name being called, either a highly preferred tangible was delivered for 30 s or an edible item, along with praise, and the response was scored as correct. If the participant did not make eye contact within 5 s of their name being called, no tangible or edible item was delivered, and it was scored as an incorrect response. After each trial, the experimenter varied her position relative to the participant's position to avoid the possibility of any side biases and to promote generalization. The experimenter rotated between sitting behind, in front of, and to each side of the participant in addition to varying sitting closer to or further away from the participant.

Treatment. The treatment phase began like the baseline phase, with the experimenter sitting approximately 0.5 to 1 m away from the participant, except the participant was not engaged in play. The experimenter activated one of the previously assessed auditory stimuli, looked toward the participant, and waited 5 s for eye contact to occur. If eye contact occurred within 5 s of the auditory stimuli, the experimenter said the participant's name while looking at him or her and then immediately delivered a highly preferred tangible item for 30 s or an edible item and delivered praise. If eye contact did not occur within 5 s of the sound, the experimenter did not say the participant's name nor deliver a tangible item and the trial was ended. The auditory stimuli varied for each trial, for example the first sound was not used again during a trial until after each of the other sounds had also been used once.

Baseline Probes. Baseline probes were conducted after every 15 treatment trials. During baseline probes, the experimenter followed the baseline procedure as previously described to determine if the participant will engage in the eye contact response without presentation of the auditory stimulus, and with the only antecedent being calling of the participant's name. If the participant made eye contact within 5 s of their name being called, the experimenter delivered either a highly preferred tangible item for 30 s or an edible item, along with praise, and it was scored as a correct response. If the participant did not make eye contact within 5 s of their name being called, no tangible item was delivered, and it was scored as an incorrect response. Mastery criteria was set at 100% of trials across 3 consecutive baseline probes.

Generalization & Maintenance Probes. Both generalization probes and maintenance probes followed the baseline probe procedure described above. Generalization was done both with a novel interventionist and in a novel setting (classroom) while the participant engaged in play. The experimenter followed the baseline probe procedure to determine if the participant would engage in the eye contact response without presentation of the auditory stimulus, and with the only antecedent being calling the participant's name. Maintenance probes were conducted two weeks after the participant met mastery criteria.

Chapter 3
Results

Figure 1 and Figure 2 show results for four participants for responding with eye contact to a name call. The y-axis represents the percentage of trials with eye contact and the x-axis indicates sessions. The first phase is the baseline phase where only differential reinforcement was used for responding to a name call with eye contact. Responses were recorded using a 5-trial block, so if the participant responded correctly for two out of the five trials, the responses was recorded as 40% correct. The following phase was the treatment phase where an auditory stimulus and response-stimulus pairing was added to differential reinforcement, again a 5-trial block system was used for data collection. After every three 5-trial blocks in the treatment phase (15 trials) baseline probes were conducted which were identical to the baseline phase. Baseline probes were recorded using a two or three trial block system based on responding. If the participant got two incorrect responses or two correct responses in a row, the probe was ended, but if the participant engaged in one incorrect and one correct response, a third trial was ran.

Results from Kevin's auditory stimuli assessment indicated that five sounds elicited an orienting response: a car horn, a speeding car, a cop car, chimes, and a duck quacking. Kevin began the baseline phase demonstrating low to moderate orienting responses, for two out of the first 5-trials, followed by a decreasing trend with stability at 0% correct responding. The average percentage of correct responding during baseline was 11.4% of trials. During the treatment phase, the first three data points remained at 0% followed by a rapid increase to 100%. Responding remained variable during the treatment phase ranging from 60% to 100%. Correct responding during the treatment phase averaged 78.3%. Kevin's responding during baseline probes was also variable, ranging from 0% correct to 100% correct, with an average of 66.7% correct responding. Responding gradually increased across baseline probes until mastery criteria of 100% correct responding across three consecutive probes was met. Kevin responded correctly at 100% for the generalization probe across settings, and 67% (2 out of 3 trials) for the generalization probe across people. Kevin responded correctly at 33% during a maintenance probe conducted two weeks post-study.

Results from Seth's auditory stimuli assessment indicated that six sounds elicited an orienting response. All six sounds were either musical introductions to songs or guitar sounds. Seth never responded correctly during the baseline phase, and data remained stable at 0% for seven baseline sessions or 35 total trials. During the treatment phase, responding gradually increased to 100%. Responding during the treatment phase was variable, ranging from 40% to 100% correct responding with an average of 88%. For the first two baseline probes of DR only, Seth responded correctly for one out of the three trials. Responding increased to 100%, then showed moderate variability from 33% to 100% and remained stable for four consecutive baseline probes. Seth's average percentage of correct responding during baseline probes was 74.9%. Seth responded correctly during 100% of generalization probes across both people and settings. Seth also responded correctly at 100% during a maintenance probe conducted five weeks post-study.

Results from Lily's auditory stimuli assessment indicated that three sounds elicited an orienting response: a cat meowing, a game buzzer, and a circus song. Lily began the baseline session by responding correctly for 40% of trials and eventually remained stable at 20% of trials for three consecutive baseline sessions. During the treatment phase, responding immediately increased to 100% of sessions and remained stable at 100% for the remainder of the treatment phase. Lily responded correctly during 100% of all three consecutive baseline probes, meeting mastery criteria. Lily responded correctly during 100% of generalization probes across both people and settings. Lily also responded correctly at 100% during a maintenance probe conducted four weeks post-study.

Results from Adam's auditory stimuli assessment indicated that four sounds elicited an orienting response: door slamming, Mickey Mouse's laugh, a doorbell, and a toilet flushing. During the baseline session for Adam, data remained stable at 0% for 7 consecutive baseline sessions (35 trials). During the treatment sessions, responding increased to 80% correct responding, increased and remained stable at 100% correct responding. Correct responding during the treatment phase averaged

93.3%. Adam also responded correctly during 100% of three consecutive baseline probes, meeting mastery criteria. Adam responded correctly at 100% for the generalization probe across people, and 67% (2 out of 3 trials) for the generalization probe across settings. Adam responded correctly at 100% during the maintenance probe conducted two weeks post-study.

Social Validity

The social validity survey for families is shown in Appendix B. Results from the social validity survey were available for Lily and Adam's parents. Results were evaluated from a range of: 1) highly unlikely to 5) highly likely. Results indicated that both parents were highly likely (with a score of 5) to continue implementing procedures (e.g., differential reinforcement). The survey also indicated that both parents were highly likely (score of 5) to recommend the procedure to others. The social validity survey for clinicians is shown in Appendix C. Kevin and Seth's case managers completed the survey and both indicated that they were likely to highly likely (scores 4 and 5) to continue implementing procedures, and highly likely (score of 5) to use the procedure for future clients.

Chapter 4
Discussion

The use of auditory stimuli to elicit an orienting response and response-stimulus pairing contingent on an eye contact response was evaluated in four children with ASD as a procedure to increase responding to a name call with eye contact. The present study included a delayed multiple-baseline across participants design, with embedded baseline probes (DR only) during the treatment phase. Advantages to this teaching procedure potentially include ease of implementation, and rapid effects on orienting behavior. Based on research by Dozier et al. (2012) and Dawson (2004) we predicted that using response-stimulus pairing and non-social auditory stimuli to elicit an orienting response would result in increases in eye contact when only differential reinforcement was used.

During baseline, we observed low levels of eye contact from participants when their names were called using the DR procedure. The DR procedure involved calling the participant's name, and following eye contact responses with provision of preferred edibles. Unlike research by others demonstrating the use of DR alone improved eye contact (e.g., Carbone, et al., 2013; Cook et al., 2017; Matson et al., 1988; Ninci et al., 2013; Thomas, Lafasakis, & Sturmey, 2010), results of this study showed that DR alone was insufficient to show improvement.

During the DR plus response-stimulus pairing treatment phase, all participants showed dramatic increases in levels and trends of eye contact responses. Two participants, Kevin and Seth, reached mastery criteria slower than Lily and Adam. The data paths during the treatment phase, including embedded baseline probes, for Kevin and Seth showed high variability in responding that may be attributed to three factors. First, Kevin and Seth, ages three and four, were younger than Lily and Adam, ages five and seven. Second, both Kevin and Seth engaged in other forms of problem behavior. Kevin engaged in visual and motor stereotypy (i.e., looking at objects from an angle, and repetitive body movements), flopping, self-injury, and negative vocalizations. Seth engaged in vocal, visual, and motor stereotypy (i.e., waving objects in front of his eyes, and hand-flapping movements). Stereotypic responses and other forms of problem behavior may have competed with the effects of the procedure. In contrast, Lily and Adam did not engage in stereotypic or other problem behavior, data showed more stability, and immediate changes in level and trend were observed.

Another variable to consider regarding the effectiveness of the treatment may have related to dosing, or frequency, of sessions. Because treatment sessions were scheduled around the participants' availability at the clinic, Kevin and Seth were only available three to four times per week for 15 min per week, with sessions lasting between 45 min to 1 hr per week. Lily and Adam participated in the study twice per week for 45 min, or 1 hr and 15 min. Rapid acquisition and mastery may have occurred for Lily and Adam due to their experiencing longer sessions less frequently per week. Future research may investigate potential differences between the number and lengths of sessions conducted per day regarding mastery and maintenance of skills. Implications of our findings for children with ASD who engage in stereotypy suggest that longer exposure to treatment may be needed to achieve mastery and maintenance of results.

These findings are also consistent with Ahearn, Parry-Cruwys, Toran, and MacDonald (2015) and Novak and Palaez (2011), that suggest if the child's gaze is fixed on the wrong environmental cues, he or she may not learn to respond to relevant cues, such as eye contact, during social interactions. Thus, participants may require systematic instruction to achieve socially significant improvement in eye contact, and particularly if stereotypy interferes with desired behavior (Ahearn, Parry-Cruwys, Toran, & MacDonald, 2015).

It is noteworthy that no other prompting procedures were required to demonstrate stimulus control over eye contact responses, as were needed in Foxx (1977) and Hall, Maynes, and Reiss (2009). Our findings are interesting because the procedure offers a less restrictive option for gaining eye contact, since no physical prompting or guided movements by therapists were required. Furthermore, all participants achieved mastery of eye contact during baseline DR-only probes, showing transfer of stimulus control to calling participants' names in the absence of the non-social auditory response. Finally, results of generalization and maintenance probes, including those implemented with novel therapists in new settings, also showed high levels of correct responses. Results maintained at two weeks post-study for Adam, but Kevin's responding during maintenance probes dropped. Results maintained at four weeks post-study for Lily and five weeks post-study for Seth.

One limitation of the study was that during the investigation, experimenters did not collect data on eye contact that occurred spontaneously, or potentially functioned under the control of other stimuli in the child's environment. For instance, some participants had acquisition programs that involved eye contact with manding for items, which may have occurred as mands (e.g., making eye contact and saying, "iPad" to request the iPad when it was not present), or mand-tacts (e.g., seeing an iPad, and saying "iPad"). Regardless of whether eye contact occurred as a mand, if eye contact occurred within 5 s of either saying the child's name (during DR), or playing non-social sounds (during DR plus response-stimulus pairing), the high-preferred stimulus was delivered. Future research may involve assessment of eye contact that occurs under different forms of control.

A second potential limitation involves the implementation of the DR and response-stimulus pairing procedures as a treatment package. In baseline, a DR procedure was used instead of no treatment to avoid placing eye contact responses on extinction. The purpose of the pairing sessions in blocked trials followed by DR-only probes was to assess whether stimulus control would occur under the DR-only procedure, and how quickly it would emerge following pairing sessions. Another design arrangement might involve a sequential design that first tests no DR, then DR alone, then DR plus response-stimulus pairing, and finally DR plus response-stimulus pairing plus an auditory stimulus to elicit an eye contact response. By separating the treatment package components, the separate effects of each procedure can be evaluated to find out which procedures are necessary for teaching eye contact in response to a name call. Another limitation of the current study is that no distractor name was used as a control to show that the presence of only the child's name, not some other name, evoked responding.

The present results demonstrate the effectiveness of a DR plus response-stimulus pairing procedure that incorporated non-social sounds to elicit eye contact, and transfer of stimulus control to calling the child's name. The transfer of stimulus control to the child's name in the absence of the non-social sounds during DR-only probes was important to establish a more naturalistic instructional procedure. Since playing non-social sounds to elicit a looking response (e.g., a car horn beeping, Mickey Mouse's laugh, or chimes) is not typical in a child's environment, the desired goal was to transfer stimulus control of the looking response to the sound of the child's name only. The results of this study hold interesting implications for teaching children with ASD to make eye contact in response to a name call, which is a pivotal skill in early child development. As discussed by other researchers, eye contact is an important prerequisite in initiating and responding to functional social interactions, learning about the social attention of others, and understanding the communicative and emotional significance of eye gaze (Jones, Carr, & Klin, 2008). Eye contact also represents an important signal of another's interest and attention, and serves to establish a communicative context (Kleinke, 1986). Research suggests that the ability to make eye contact in early childhood leads to higher academic and social achievement and functions as prelinguistic skills that are highly predictive of the rate of language acquisition (Carbone, O'Brien, Sweeney-Kerwin, and Albert, 2013; Charman, et al., 2003; Kleinke, 1986). Teaching children to respond with eye contact to their name helps them both academically (e.g., looking at a teacher when they give an instruction) and socially (e.g., looking at a peer while engaging in play). Teaching children with ASD eye contact is also an essential safety skill, for instance, responding to a parent calling his or her name to warn a child to avoid an unsafe situation.

Figure 1

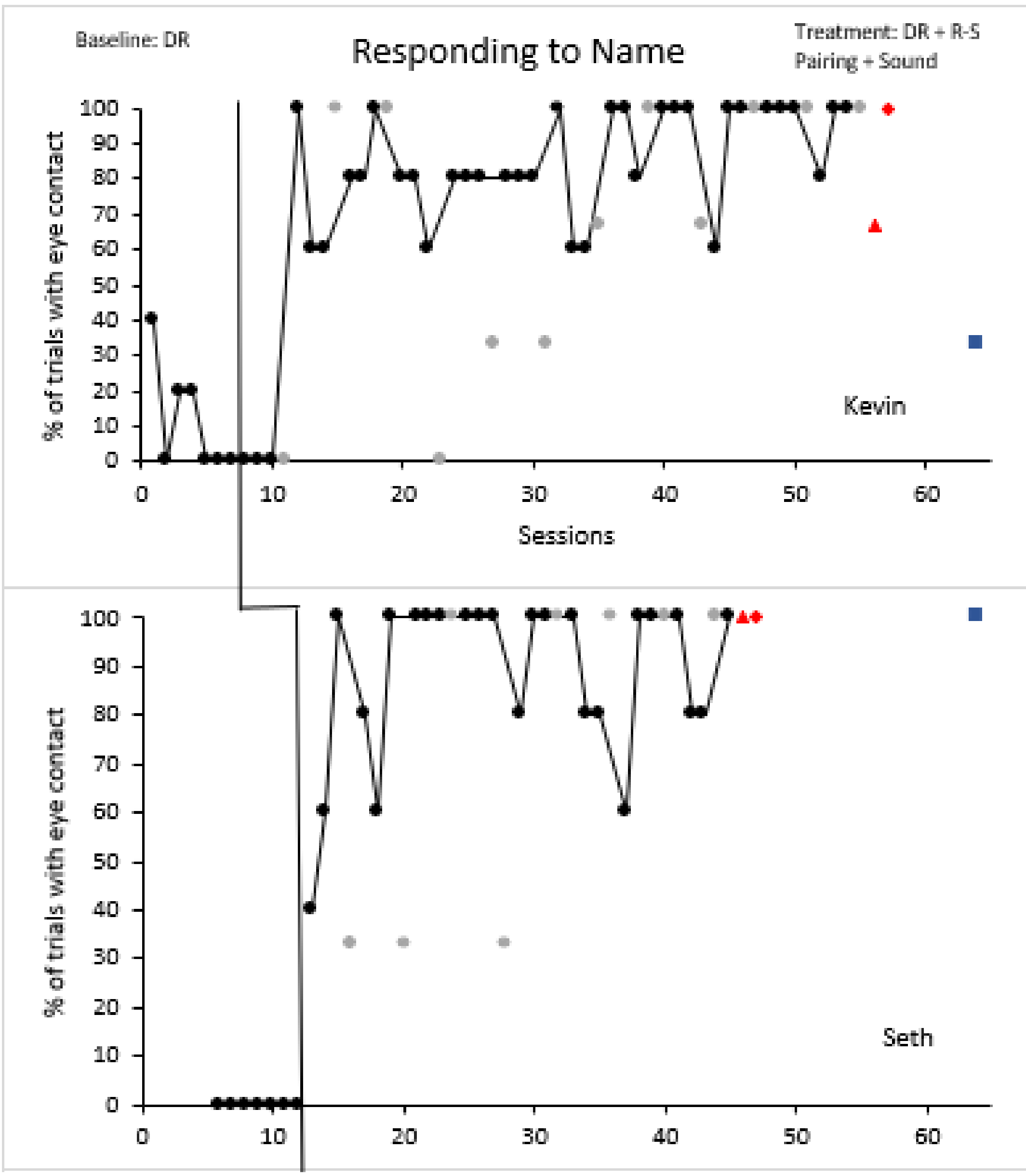

Figure 1: Results shown for Kevin and Seth. Black datapoints represent responding in baseline and treatment phases. Gray datapoints represent baseline probes, red triangles represent generalization probes across people, red diamonds represent generalization probes across settings, and blue squares represent maintenance probes.

Figure 2

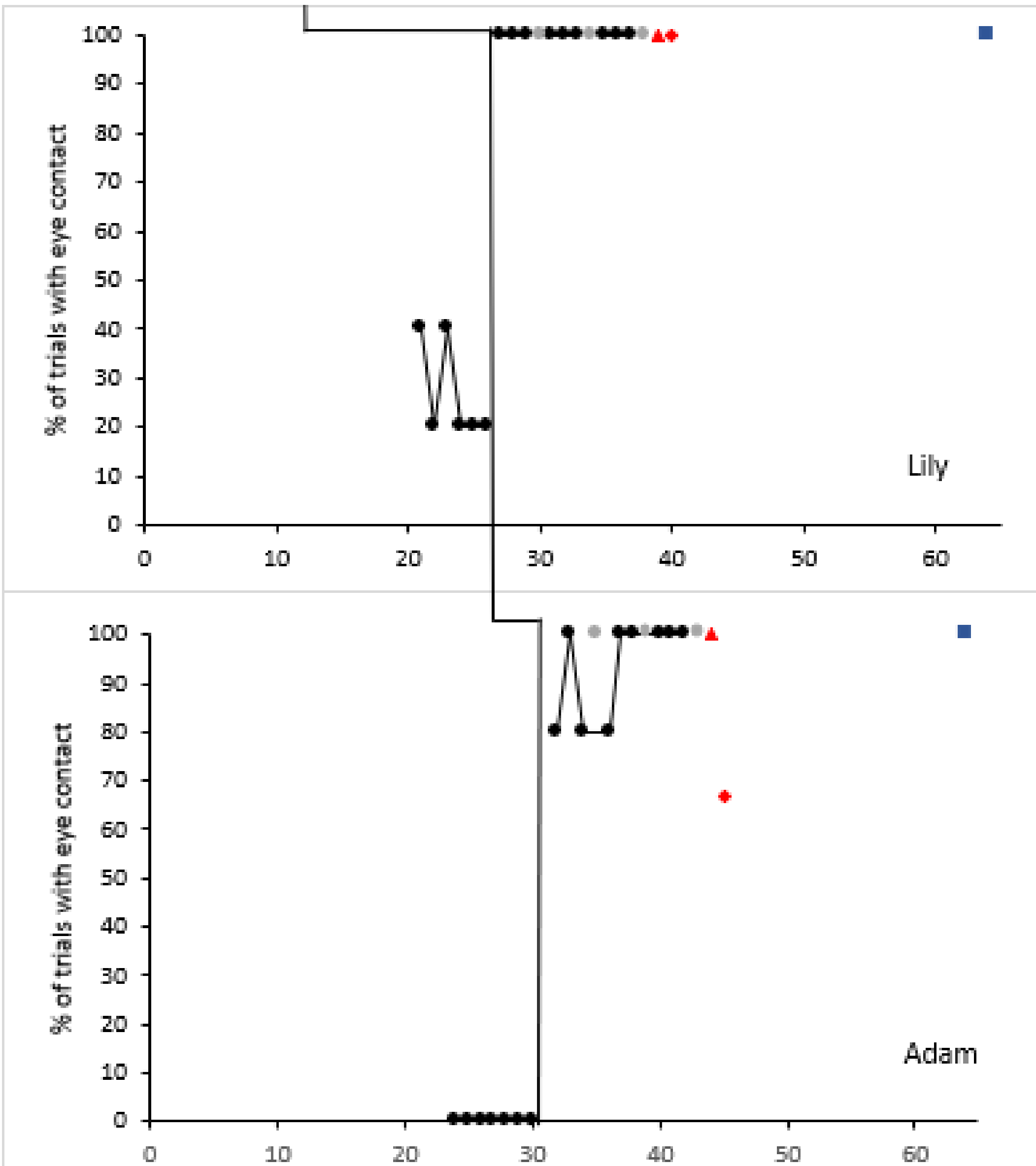

Figure 2: Results shown for Lily and Adam. Black datapoints represent responding in baseline and treatment phases. Gray datapoints represent baseline probes, red triangles represent generalization probes across people, red diamonds represent generalization probes across settings, and blue squares represent maintenance probes.

References

Ahearn, W. H., Parry-Cruwys, D., Toran, T., & MacDonald, J. (2015). Stimulus salience in autism: a social learning disorder. In *Autism Service Delivery* (pp. 75-111). Springer, New York, NY.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5™* (5th ed.). Arlington, VA: American Psychiatric Publishing, Inc. http://dx.doi.org/10.1176/appi.books.9780890425596

Barbaro, J., & Dissanayake, C. (2013). Early markers of autism spectrum disorders in infants and toddlers prospectively identified in the Social Attention and Communication Study. *Autism, 17*, 64–86. http://dx.doi.org/10.1177/1362361312442597

Beaulieu, L., Hanley, G. P., & Roberson, A. A. (2012). Effects of responding to a name and group call on preschoolers' compliance. *Journal of Applied Behavior Analysis, 45*, 685–707.

Beus, B. (2014). Conditioned Reinforcement and the value of praise in children with autism. *All Graduate Theses and Dissertations*. 3848. https://digitalcommons.usu.edu/etd/3848

Buitelaar, J. K. (1995). Attachment and social withdrawal in autism: Hypotheses and findings. *Behaviour, 132*, 319–350. http://dx.doi.org/10.1163/156853995X00595.

Buzsáki, G. (1982). The "where is it?" reflex: Autoshaping the orienting response. *Journal of the Experimental Analysis of Behavior*, *37*(3), 461-484.

Carbone, V. J., O'Brien, L., Sweeney-Kerwin, E. J., & Albert, K. M. (2013). Teaching eye contact to children with autism: A conceptual analysis and single case study. *Education & Treatment of Children, 36*, 139–159. http://dx.doi.org/10.1353/etc.2013.0013

Centers for Disease Control and Prevention. (2018,). Autism Spectrum Disorder (ASD). Retrieved from https://www.cdc.gov/ncbddd/autism/data.html

Centers for Disease Control and Prevention. (2018). Noise and hearing loss prevention. Retrieved from: https://www.cdc.gov/niosh/topics/noise/default.html

Cook, J. L., Rapp, J. T., Mann, K. R., McHugh, C., Burji, C., & Nuta, R. (2017). A practitioner model for increasing eye contact in children with autism. *Behavior Modification, 41*, 382–404. http://dx.doi.org/10.1177/0145445516689323

Charman, T. (2003). Why is joint attention a pivotal skill in autism? In U. Frith & E. Hill (Eds.), *Autism: Mind and brain* (pp. 67–87). New York, NY: Oxford University Press.

Charman, T., Drew, A., Baird, C., & Baird, G. (2003). Measuring early language development in preschool children with autism spectrum disorder using the MacArthur Communicative Development Inventory (Infant Form). *Journal of Child Language, 30*, 213–236. http://dx.doi.org/10.1017/S0305000902005482

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Applied behavior analysis. Columbus, OH, England: Merrill Publishing Co.

Dawson, G., Meltzoff, A. N., Osterling, J., Rinaldi, J., & Brown, E. (1998). Children with autism fail to orient to naturally occurring social stimuli. *Journal of autism and developmental disorders*, *28*(6), 479-485.

Dawson, G., Toth, K., Abbott, R., Osterling, J., Munson, J., Estes, A., & Liaw, J. (2004). Early social attention impairments in autism: social orienting, joint attention, and attention to distress. *Developmental psychology*, *40*(2), 271.

Dozier, C. L., Iwata, B. A., Thomason-Sassi, J., Worsdell, A. S., & Wilson, D. M. (2012). A comparison of two pairing procedures to establish praise as a reinforcer. *Journal of Applied Behavior Analysis*, *45*(4), 721-735.

Foxx, R. M. (1977). Attention training: The use of overcorrection avoidance to increase the eye contact of autistic and retarded children. *Journal of Applied Behavior Analysis, 10*, 489–499. http://dx.doi.org/10.1901/jaba.1977.10-489

Goldberg, M. C., Allman, M. J., Hagopian, L. P., Triggs, M. M., Frank-Crawford, M. A., Mostofsky, S. H., & DeLeon, I. G. (2017). Examining the reinforcing value of stimuli within social and non-social contexts in children with and without high-functioning autism. *Autism*, *21*(7), 881-895.

Grastyán, E., & Vereczkei, L. (1974). Effects of spatial separation of the conditioned signal from the reinforcement: A demonstration of the conditioned character of the orienting response or the orientational character of conditioning. *Behavioral Biology*, *10*(2), 121-146.

Hall, S. S., Maynes, N. P., & Reiss, A. L. (2009). Using percentile schedules to increase eye contact in children with fragile X syndrome. *Journal of Applied Behavior Analysis, 42*, 171–176. http://dx.doi.org/10.1901/jaba.2009.42-171

Hamlet, C. C., Axelrod, S., & Kuerschner, S. (1984). Eye contact as an antecedent to compliant behavior. *Journal of Applied Behavior Analysis, 17*, 553–557. http://dx.doi.org/10.1901/jaba.1984.17-553

Jones, W., Carr, K., & Klin, A. (2008). Absence of preferential looking to the eyes of approaching adults predicts level of social disability in 2-year-old toddlers with autism spectrum disorder. *Archives of General Psychiatry, 65*, 946–954. http://dx.doi.org/10.1001/archpsyc.65.8.946

Jones, W., & Klin, A. (2013a). Attention to eyes is present but in decline in 2-6-month-old infants later diagnosed with autism. *Nature, 504*, 427–431. http://dx.doi.org/10.1038/nature12715.

Jones, W., & Klin, A. (2013b). Social engagement in the first two years of life in autism spectrum disorders. In M. A. Just & K. A. Pelphrey (Eds.), *Carnegie Mellon symposia on cognition: Development and brain systems in autism* (pp. 123–147). New York, NY: Psychology Press.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217–250.

Kanner, L. (1944). Early infantile autism. *The Journal of Pediatrics, 25*, 211–217.http://dx.doi.org/10.1016/S0022-3476(44)80156-1

Kleinke, C. L. (1986). Gaze and eye contact: A research review. *Psychological Bulletin, 100*, 78–100. http://dx.doi.org/10.1037/0033-2909.100.1.78

Koch, J. (1967). Conditioned orienting reactions in two-month-old infants. *British Journal of Psychology*, *58*(1-2), 105-110.

Matson, J. L., Manikam, R., Coe, D., Raymond, K., Taras, M., & Long, N. (1988). Training social skills to severely mentally retarded multiply handicapped adolescents. *Research in developmental disabilities*, *9*(2), 195-208.

Miller, N., Wyatt, J., Casey, L. B., & Smith, J. B. (2018). Using computer-assisted instruction to increase the eye gaze of children with autism. *Behavioral Interventions*, *33*(1), 3-12.

Mundy, P. (2003). The neural basis of social impairments in autism: the role of the dorsal medial-frontal cortex and anterior cingulate system. *Journal of Child Psychology and Psychiatry, 44*, 793–809.

Ninci, J., Lang, R., Davenport, K., Lee, A., Garner, J., Moore, M., ... & Lancioni, G. (2013). An analysis of the generalization and maintenance of eye contact taught during play. *Developmental neurorehabilitation*, *16*(5), 301-307.

Novak, G., & Pelaez, M. (2011). Autism: A behavioral-systems approach. *Behavioral foundations of effective autism treatment*, 13-33.

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of autism and developmental disorders*, *24*(3), 247-257.

Osterling, J. A., Dawson, G., & Munson, J. A. (2002). Early recognition of 1-year-old infants with autism spectrum disorder versus mental retardation. *Development and psychopathology*, *14*(2), 239-251.

Pavlov, I. P., & Anrep, G. V. (1928). *Conditioned reflexes: An investigation of the physiological activity of the cerebral cortex*. London: Oxford University Press.

Prokasy, W. F. (1977). First interval skin conductance responses: Conditioned or orienting responses?. *Psychophysiology*, *14*(4), 360-367.

Rodriguez, P. P., & Gutierrez, A. (2017). A comparison of two procedures to condition social stimuli to function as reinforcers for children with autism. *Behavioral Development Bulletin*, *22*(1), 159.

Rodriguez, P. (2013). Operant and Respondent Procedures to Establish Social Stimuli as Reinforcers in Children with Autism.

Senju, A., & Johnson, M. H. (2009). Atypical eye contact in autism: Models, mechanisms and development. *Neuroscience and Biobehavioral Reviews, 33*, 1204–1214. http://dx.doi.org/10.1016/j.neubiorev.2009.06.001

Senju, A., Yaguchi, K., Tojo, Y., & Hasegawa, T. (2003). Eye contact does not facilitate detection in children with autism. *Cognition, 89*, B43–B51. http://dx.doi.org/10.1016/S0010-0277(03)00081-7

Sundberg, M. L. (2008). *VB-MAPP Verbal Behavior Milestones Assessment and Placement Program: a language and social skills assessment program for children with autism or other developmental disabilities: guide*.

Tetreault, A. S., & Lerman, D. C. (2010). Teaching social skills to children with autism using point-of-view video modeling. *Education and Treatment of Children*, *33*(3), 395-419.

Thomas, B. R., Lafasakis, M., & Sturmey, P. (2010). The effects of prompting, fading, and differential reinforcement on vocal mands in non-verbal preschool children with autism spectrum disorders. *Behavioral Interventions: Theory & Practice in Residential & Community-Based Clinical Programs*, *25*(2), 157-168.

U.S. Department of Health and Human Services. (2017). National Institute on Deafness and Other Communication Disorders. Retrieved from: https://www.nidcd.nih.gov/research/clinical-studies

Zuromski, E. S. (1975). *The effect of the conditioned orienting response on learning a two-choice discrimination task by mentally retarded individuals* (Doctoral dissertation, ProQuest Information & Learning).

Zwaigenbaum, L., Bryson, S., & Garon, N. (2013). Early identification of autism spectrum disorders. *Behavioural Brain Research, 251*, 133–146. http://dx.doi.org/10.1016/j.bbr.2013.04.004

Zwaigenbaum, L., Bryson, S., Lord, C., Rogers, S., Carter, A., Carver, L., Yirmiya, N. (2009). Clinical assessment and management of toddlers with suspected autism spectrum disorder: Insights from studies of high-risk infants. *Pediatrics, 123*, 1383–1391. http://dx.doi.org/10.1542/peds.2008-1606

Appendix A
Treatment Integrity

Baseline Treatment Integrity

Participant: Session number: Phase: Therapist: Treatment integrity check: Date:	(1) Says name while participant is engaged with toys	
	(2) Varies sitting position from previous trial	
	(3) Provides differential reinforcement for correct responding (edible or 30s tangible)	
	(4) Records data after each trial	

Treatment Phase Treatment Integrity

Participant: Session number: Phase: Therapist: Treatment integrity check: Date:	(1) Sits facing participant 1-2 ft away	
	(2) Plays sound that is not the same as previous sound	
	(3) Provides differential reinforcement for correct responding (edible or 30s tangible)	
	(4) Records data after each trial	

Appendix B
Family Survey

Responding to Name Call- Family Survey

1. On a scale of 1 to 5 with 1 being Not Likely and 5 being Highly Likely, how likely are to continue implementing procedures as described by the experimenter?

2. On a scale of 1 to 5 with 1 being Not Likely and 5 being Highly Likely, how likely would you be to recommend this teaching procedure to others in the future?

3. Please list any comments or concerns you have with this teaching procedure.

Appendix C
Clinician Survey

Responding to Name Call- Clinician Survey

1. On a scale of 1 to 5 with 1 being Not Likely and 5 being Highly Likely, how likely are to continue implementing procedures as described by the experimenter?

2. On a scale of 1 to 5 with 1 being Not Likely and 5 being Highly Likely, how likely would you be to implement this procedure for future clients?

3. Please list any comments or concerns you have with this teaching procedure.