This is a post-peer-review, pre-copyedit version of a chapter published in the *Handbook of social behavior and skills in Children* edited by J. L. Matson. The final authenticated version is available online at: https://doi.org/10.1007/978-3-319-64592-6_8

Behavior Analytic Methods

Marc J. Lanovaz, Marie-Michèle Dufour, and Malena Argumedes

Université de Montréal

Author Note

We thank Jennifer L. Cook for her comments on an earlier draft of this manuscript.

Correspondence concerning this chapter should be addressed to Marc J. Lanovaz, École de Psychoéducation, Université de Montréal, C.P. 6128, succursale Centre-Ville, Montreal, QC, Canada, H3C 3J7.

Email: marc.lanovaz@umontreal.ca

Abstract

Behavior analysts typically conceptualize social skills as behaviors, or series of behaviors, that mediate the responses of others. As such, practitioners may assess and teach social skills using the principles of learning derived from operant conditioning (e.g., positive reinforcement). In the current chapter, we first discuss the conceptualization of social skills from a behavior analytic standpoint. That is, social skills are behaviors that are evoked by environmental stimuli and reinforced by others. Next, we describe behavioral assessments that may be useful to conduct prior to teaching social skills to children such as task analysis, preference assessment, and functional assessment. Finally, we review teaching strategies that may be adopted by practitioners to teach the social skills identified by assessments. These strategies include prompting, fading, chaining, shaping, and discrete trial training. We also discuss how to adapt reinforcement schedules to teach social skills and present multiple methods to promote the generalization of the newly learned skills.

Keywords: behavioral assessment, behavior analysis, behavioral intervention, children, social skills

Introduction

From a behavior analytic standpoint, socials skills are typically conceptualized as behaviors or series of complex behaviors that have an impact on the responses of others (McFall, 1982). The principles of operant conditioning thus apply to the development and generalization of social skills in children (Allen, Hart, Buell, Harris, & Wolf, 1964; Chandler, Lubeck, & Fowler, 1992; Odom & McConnell, 1992). These principles are not only used to explain the emergence and maintenance of social skills, but also to treat difficulties in both children with and without disability. Young children learn social skills by contacting the social contingencies present in their environment. These social contingencies typically include three components: a discriminative stimulus, a response, and a social consequence (Cooper, Heron, & Heward, 2007).

The discriminative stimulus appears before the response (i.e., social behavior). The response is more likely to be followed by a reinforcing consequence in its presence than in its absence. In other words, the discriminative stimulus signals the availability of the reinforcer maintaining the social behavior. Assume that playing is a reinforcing activity for a child, Billy. When Billy asks his friend Tara to play with him, she only agrees when they are in the schoolyard; otherwise, she refuses to play with him. Thus, the schoolyard functions as a discriminative stimulus because the social behavior of asking to play is more likely to be followed by reinforcement (i.e., playing) within this specific context.

The second component of the contingency is the response, which is the social behavior emitted by the child. Social behaviors may take on many forms ranging from

simple nonverbal interactions (e.g., eye contact, gesturing) to complex verbal exchanges (e.g., conversations on abstract topics). Although social behaviors can vary widely in form (sometimes referred to as topography), they share the commonality of resulting in some type of social consequence. More complex behaviors can be specifically conceptualized as behavior chains, which are series of responses. For example, the behavior of saying “hi” to a friend in the hallway may be further divided into smaller units: (a) stopping approximately 1.5 m in front of the friend, (b) looking at the friend, (c) saying “hi”, and (d) waiting for a response. Within a behavior chain, the first response serves as the discriminative stimulus for the second response, the second response for the third response and so on.

The social consequence is the final component of the contingency, which is used to explain the development and maintenance of social skills. A social consequence is a stimulus event mediated by another person that is provided contingent on the occurrence of the social behavior. If the consequence increases responding, it is referred to as a reinforcer. Contrarily, consequences that decrease responding are referred to as punishers. For example, most mothers are more likely to talk to their babies in a soothing voice when they smile. If the infant smiles more often as a result, the mother’s talking in a soothing voice would be considered as a social reinforcer for smiling. In contrast, if a mother scolds her young child when he screams and it results in a reduction of screaming, scolding would be considered as a social punisher. In both previous examples, the consequence involved the addition of stimulus (i.e., positive reinforcement and punishment). Social behavior may also result in the removal of a stimulus (i.e., negative

reinforcement and punishment). If a child asks a friend to stop playing a game, the removal of the game may function as a reinforcer for the social behavior of asking to stop.

Traditionally, most learned behaviors are explained using this three-term contingency, but behavior analysts have been increasingly turning to a fourth term to supplement their analyses, the motivating operation (Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1993). Motivating operations are stimulus events that alter both the value of a consequence and the frequency of the behavior associated with it. The abolishing operation reduces the value of a consequence whereas the establishing operation increases its value. For example, engaging in the same activity (e.g., game) for extended periods of time may reduce its value as well as the behavior of engaging in the activity. In this case, the stimulus event (extended duration of engagement in the activity) functions as an abolishing operation. As an example of establishing operation, assume that two children are playing together. When a third child arrives, they ask her to play tag. Even though tag was available as a game beforehand, the presence of a third child increased the value of the game and the frequency of asking to play tag, functioning as an establishing operation for the behavior.

Within a behavior analytic conceptualization, the practitioner generally aims to manipulate these contingencies to teach children social skills. For example, a practitioner may add discriminative stimuli (e.g., prompts) to facilitate the correct execution of the behavior, use stimulus events functioning as establishing operations to increase the value of the reinforcer associated with the social behavior, or alter the consequences contingent

on engagement in the behavior. Multiple interventions have been derived from the principles of applied behavior analysis to support the acquisition, generalization, and maintenance of social skills in children. The next section presents common behavioral assessments that may be warranted prior to the implementation of interventions for social skills. Then, we define and discuss methods that have been used to increase interactions and improve social skills in children.

Behavioral Assessment

Assessment is the first step conducted by the practitioner when aiming to improve social skills in children. Direct observation methods, checklists, and scales are all options available to practitioners who need to assess social skills (Gresham & Elliott, 1984; Matson & Wilkins, 2009). As these assessment methods have already been reviewed previously (see Chapters 6 through 8), providing a detailed description goes beyond the scope of the current chapter. That said, we will provide an overview of three behavioral assessments that are often central to the success of interventions based on behavior analytic principles: task analysis, preference assessment, and functional assessment. These three assessments may support practitioners in planning their interventions and optimizing treatment effects when teaching social skills.

Task Analysis

Prior to teaching complex skills, practitioners often conduct a task analysis, which involves the division of a behavior into smaller units (i.e., a behavior chain; Neidert, Dozier, Iwata, & Hafen, 2010). According to Cooper et al. (2007), there are three methods to construct a task analysis: observing skilled persons preforming the target task,

consulting an expert of the target task in question, and performing the task yourself. By dividing complex behaviors into smaller units, it becomes easier to measure and to teach. Once every step of the chain is clearly defined, it is essential to assess the child's ability for each of the chain units. The practitioner can then develop a checklist that describes each unit that the child must perform. Two methods may be used to assess the units of the task analysis: single and multiple opportunities. The single opportunity assessment consists of assessing the task in the correct order. The assessment typically ends when the child fails one of the steps because the discriminative stimulus to produce the subsequent units of the chain is absent. During multiple opportunities assessment, the instructor assesses each unit of the chain, providing prompts if necessary so that the child has the opportunity to perform each step.

In an example of single opportunity assessment, Parker and Kamps (2011) conducted a task analysis in order to assess performance during social activities in two high functioning children with autism spectrum disorder (ASD). During baseline, the instructor simply asked the participants to complete the tasks without further prompting. Given that the tasks had to be completed in a certain order, the child did not have the opportunity to perform the subsequent tasks if the first one was not executed or was performed incorrectly. In contrast, Haring, Kennedy, Adams, and Pitts-Conway (1987) conducted a task analysis to assess community skills in young adult with ASD. During the initial assessment, the instructor presented relevant prompts so that the youth could emit a step even if the previous step had been failed. Although this study was conducted with young adults, the level of functioning of the participants was low (functioned at

levels of four and five years old), suggesting that this method may also be relevant to young children.

Preference Assessment

Engagement in appropriate social behaviors typically generates reinforcing consequences through continuing interactions with others. For some children, social consequences may not be sufficient to lead to the acquisition of new social behaviors for two reasons. First, the execution of the behavior may not be correct or accurate during the learning process, which may fail to lead to the delivery of social reinforcement in the natural environment. Thus, the child may not contact the social contingency frequently enough to increase responding. Second, social consequences may not be a potent reinforcer for the child in question. In this case, an additional reinforcer should be paired with the social consequence in order to (a) condition the social responses of others as reinforcers and (b) strengthen the novel social behavior. Because most of the interventions for teaching social skills have a reinforcement component, assessing preferred stimuli is paramount.

Preference assessments are procedures designed to assist practitioners in identifying preferred stimuli for treatment (Graff & Karsten, 2012). The stimuli evaluated within preference assessments can take on many forms such as edibles (e.g., preferred food), leisure items (e.g., toys, games), sensory stimuli (e.g., music), or even other types of social stimuli (e.g., praise, tickles; Virués-Ortega et al., 2014). During treatment, the practitioner can either provide preferred stimuli directly as reinforcers or use them as back-up reinforcers within a token economy (Doll, McLaughlin, & Barretto, 2013). One

of the simplest methods and least time consuming procedure to assess preference is the use of surveys (Resetar & Noell, 2008; Rotatori, Fox, & Switzky, 1979). In this type of indirect assessment, a survey is administered to the child, a teacher or parent to identify the preferred stimuli of the child. However, studies have indicated that this method does not necessarily identify the most potent reinforcers (Hagopian, Long, & Rush, 2004; Northup, George, Jones, Broussard, & Vollmer, 1996), which suggests that direct assessments methods should be used when possible.

During direct assessments of preference, the child has the opportunity to directly access the stimuli in the assessment and the practitioner measures whether the child interacts with the stimulus or the duration of interaction. Depending on the functioning of the child and type of stimulus, interactions can include approaching, manipulating, consuming, picking up, or gazing at the item (Virués-Ortega et al., 2014). Typically, direct preference assessments involve between 5 and 15 stimuli, which will vary according to stimulus category and type of assessment, and begin by sampling so that the child has the opportunity to interact with the stimuli beforehand. The four most common procedures are the single-stimulus assessment, the paired-choice assessment, the multiple stimulus assessment, and the free-operant assessment (Graff & Karsten, 2012; Kang et al., 2013; Virués-Ortega et al., 2014).

During the single-stimulus assessment (Pace, Ivancic, Edwards, Iwata, & Page, 1985), the practitioner presents each stimulus one at a time for a brief period of time (e.g., 30 s) and records whether the child interacts with the stimulus or not. The procedure is generally repeated several times for each stimulus. The most preferred items are the ones

selected the most often. Alternatively, the practitioner may measure the duration of interaction with the stimulus, which may be useful for assessing preference for activities; in this case, the item with which the child interacts for the longest duration is considered the most preferred (Hagopian, Rush, Lewin, & Long, 2001). The single-stimulus assessments have the advantage of being straightforward to implement and can be rapid to complete. The main disadvantage is that the procedures may produce multiple false positives and prevent rank ordering as some children may interact with all stimuli.

The paired-choice preference assessment involves presenting stimuli in pairs (Fisher et al., 1992). Each stimulus is presented with each other stimulus once, so that all stimuli are eventually paired together in a random order. During each presentation, the child is asked to choose between one of two stimuli and can interact with the one selected for a short period of time (e.g., 30 s). The practitioner records the item selected on each trial (if any) and the one selected the most frequently is the most preferred. The methodology has also been adapted to assess preference for music and video recordings (Chebli & Lanovaz, 2016; Horrocks & Higbee, 2008). The paired-choice method has the advantage of ranking the items in order of preference, but the procedures can be time consuming, especially as the number of items assessed increases.

The multiple stimulus assessments are similar to the paired-choice method, but all stimuli are presented simultaneously (DeLeon & Iwata, 1996). Two versions of the multiple stimulus assessment are available to practitioners. In the multiple stimulus with replacement method, the practitioner records the selection and replaces the selected item in the array following each choice. In the multiple stimulus without replacement method,

the practitioner records the rank at which the item was selected and does not replace it in the array following its selection. The multiple stimulus without replacement is generally recommended first amongst all the methods because of its rapid administration and its ranking of items (Kang et al., 2013). Conditions in which other methods may be preferable include when (a) the child engages in problem behaviors contingent on the removal items, (b) assessing preference for activities, and (c) assessing preference in children with severe disabilities, which may limit the number of items that can be presented simultaneously.

A final alternative is the free-operant preference assessment, which consists of providing access to multiple stimuli simultaneously during a period of 5 to 15 min and recording the duration of interaction with each item (Roane, Vollmer, Ringdahl, & Marcus, 1998). This method has the benefit of having a predictable duration and may result in lower levels of problem behaviors as items are not removed (Verriden & Roscoe, 2016). It should be noted that the method may produce false negatives as some children may only interact with one item during the entire duration of the session, limiting its utility when multiple preferred stimuli must be identified and ranked.

In sum, practitioners should strongly consider conducting a preference assessment when planning to use reinforcers as part of their treatment. The multiple stimulus without replacement method has clear advantages, especially for children who do not have an intellectual disability and engage in few problem behaviors. That said, the other procedures may prove particularly useful when it is not possible or advisable to implement the multiple stimulus without replacement procedure.

Functional Assessment

As previously discussed in the introduction to this chapter, the behavior analytic conceptualization of social skills implies that these behaviors have social functions. That is, children engage in social skills to contact social contingencies in their environment. These functions can be numerous such as accessing a desired item mediated by another person, seeking attention, or terminating an activity with a partner. As such, conducting a functional assessment can be particularly useful when either identifying the contingencies maintaining an inappropriate social behavior or when attempting to target a replacement behavior (Frea & Hughes, 1997; Maag, 2005). By identifying the specific function of the social behavior, the practitioner may more precisely select alternatives that will allow the child to contact similar social contingencies. Adopting a functional approach may thus improve the probability of success of the social skills intervention (Hurl, Wightman, Haynes, & Virues-Ortega, 2016; Matson, Bamburg, Cherry, & Paclawskyj, 1999). For details on conducting functional assessments, we refer the reader to Chapter 3 on Challenging Behavior, which provides a thorough review of the different methods.

Behavioral Treatment

Many treatments to improve social skills in children have been derived from applied behavior analysis. For clarity, we present each behavior analytic method individually in our review of treatments. However, nearly all treatments involve the implementation of multiple methods simultaneously in order to support the development and maintenance of new social skills; we thus encourage practitioners to combine these methods to meet their treatment objectives. We did not review self-management and

behavioral skills training as part of the current chapter as they are thoroughly covered in subsequent sections of this book (see Chapters 10 and 11).

It should be noted that a lot of the research on behavior analytic interventions to improve social skills in with children without developmental disability has been conducted more than 20 years ago. More recently, research has focused on social skills in children with ASD and other developmental disabilities. Our review of the interventions will provide an overview of both older and more recent research on the topic. Given that the principles of behavior apply to all (regardless of diagnosis), the results are most likely generalizable from one population to another.

Prompting

One of the most common components of behavioral interventions used to teach social skills to children is prompting. Prompting involves the addition or modification of a stimulus prior to the occurrence of the behavior that increases correct responding. In other words, the parent or instructor adds supplementary antecedent stimuli to help a child perform a skill (Odom & Strain, 1984; Spence, 2003). During social skills training, the use of prompting procedures aims to reduce errors while teaching new socially appropriate behaviors.

The two main types of prompts are stimulus prompts, which involve the addition or modification of a social cue, and response prompts, which operate directly on the behavior. Stimulus prompts are divided in two categories: extra-stimulus prompts and intra-stimulus prompts (Shreibman, 1975). When providing an extra-stimulus prompt, the parent or instructor adds a stimulus (prompt) to increase the child's correct responding.

For example, Ivy, Lather, Hatton, and Wehby (2016) used automated tactile cues delivered by a vibrating pager to prompt children with visual impairments to engage in pro-social behavior during lunchtime (i.e., eating with mouth closed). The prompting procedure was effective at increasing the pro-social behavior in all three participants. In another example of extra stimulus prompts, Harrell, Kamps, and Kravits (1997) taught three children with ASD strategies to maintain social interactions with others. To this end, one the components of the intervention involved cue topic cards to prompt conversations during lunchtime.

When implementing an intra-stimulus prompt, the instructor enhances a component of the discriminative stimulus that helps the child respond correctly. In an example of intra-stimulus prompt, Taylor and Hoch (2008) taught a child to respond to pointing. As a prompt, the instructor exaggerated the pointing gesture and accompanying verbal command in order to increase the salience of the discriminative stimulus (i.e., the stimulus [pointing] was enhanced to facilitate responding). In a study of the perception of robots by children with ASD, Peca, Simut, Pintea, Costescu, and Vanderborght (2014) reported that children preferred robots with exaggerated facial features. Using this type of intra-stimulus prompt may facilitate the initial development of receptive nonverbal social skills as the child may be more readily able to identify emotions and nonverbal cues when the facial features are more salient.

Response prompts can also be further divided into three categories: verbal instructions, physical guidance, and modeling (Cooper et al., 2007). Verbal instructions are frequently used to teach new behaviors in training contexts; they can either be vocal

or nonvocal instructions (e.g., written). Koegel, Koegel, Hurley, and Frea (1992) used verbal instructions to teach four boys with autism to self-manage their edible reinforcers after successfully responding to questions from others. In order to support the participants, the instructor provided verbal cues such as “What happens when you earn all of your points?” or “How many points did you earn?”. Another example of verbal instructions is the use of social scripts, which involves written or audio recorded cues to teach social initiations and interactions (Brown, Krantz, McClannahan, & Poulson, 2008; Cowan & Allen, 2007). Social scripts have been shown effective in teaching children to increase social initiations, to interact with their peers, and to engage in conversations about various topics (Krantz & McClannahan, 1993, 1998; Sarokoff, Taylor, & Poulson, 2001). In most cases, scripts are gradually faded when the children show mastery of the socials skills so that the newly learned behaviors are emitted in the presence of natural stimuli.

Physical guidance refers to the instructor physically assisting the child with movements to improve the accuracy of the social behavior. O'Connell, Lieberman, and Petersen (2006) explain that when paired with verbal instructions and proper feedback (i.e., adapted to the level the child’s receptive language), physical guidance is crucial for teaching children with visual impairments and developmental delays. Physical guidance is often used to teach motor skills, like playing games or physically requesting attention.

Modeling refers to providing a demonstration of the targeted social behavior prior to its performance by the child. To learn by modeling, children should be able to imitate immediately after the stimulus has been presented (within 3 to 5 s). During modeling, the

child watches a model of the social behavior to be executed. This model can be presented *in vivo* or through video. Video modeling is usually implemented by presenting a video recorded sample of the specific social behavior to the child. Then, the child is asked to perform the sequence. In video modeling, models can either be adult models, peer models, self-models, point-of-view models, or mixed models (any combination of the previous models; McCoy & Hermansen, 2007). McCoy and Hermansen (2007) have indicated that adults as models have been effective in increasing play skills, perspective taking skills and conversation skills for children with ASD. Peer modeling has also been effective in increasing and generalizing communication skills in social situations. As mentioned by Reichow and Volkmar (2010) in a review of social skills, more studies are needed to clarify what type of model may lead to better outcomes in teaching social skills.

Video self-modeling can either involve (a) videotaping children and editing out inappropriate behaviors to focus on the appropriate social behavior or (b) watching an unedited video so the children can self-critique their performance. Video self-modeling has demonstrated encouraging results in increasing socially relevant behaviors, but more studies are needed to further support its effectiveness (Hagiwara & Myles, 1999; McCoy & Hermansen, 2007). Point-of-view modeling involves showing video footage as if the child was engaged in the sequence. Relatively new, this approach has been effective in teaching play skills and other developmental skills to children with ASD and without developmental delay (Norman, Collins, & Schuster, 2001; Schipley-Benamou, Lutzker, & Taubman, 2002). Finally, mixed models have been used to teach conversational skills,

social initiation skills, and play skills to children with variable results (Maione & Miranda, 2006; Sherer et al., 2001). When compared to *in vivo* modeling, video modeling seems to produce faster results and better generalization of social behaviors (Charlop-Christy, Le, & Freeman, 2000). It may also be less time consuming and more cost efficient (Graetz, Mastropieri, & Scruggs, 2006). Once videotaped, the sequence may be used numerous times by different instructors without being modified.

Fading

When using prompts, the purpose is to gradually fade them until the child is able to respond in their absence (Riley, 1995). Four different procedures can be used to transfer control of the response from the prompt to the natural social discriminative stimulus: most-to-least prompting, graduated guidance, least-to-most prompting, and time delay (Barton & Wolery, 2008). Most-to-least prompting is a strategy in which the instructor initially provides guidance using more intrusive prompts and then gradually replaces them with less intrusive ones until the child performs the skill in the absence of prompting. The amount of guidance is gradually reduced as the child begins to perform the social skill correctly with less instructor assistance. Often, most to-least prompting begins with physical guidance, then moves to gestural prompts followed by verbal instruction, and ends with the natural social discriminative stimulus. Jones (2009) implemented most-to-least prompting in order to teach joint attention skills to two children with ASD. In this case, the instructor began with physical guidance, then replaced it by pointing, and finally introduced a 4-s time delay. Most-to-least prompting has also been shown effective in teaching play and communication skills to children with

ASD and other developmental disabilities (Taylor and Hoch, 2008). Graduated guidance is a variation of most-to-least prompting, but in this case, the practitioner only uses physical prompts and gradually fades the different forms until the learner emits the behavior without additional prompts (Bryan & Gast, 2000; MacDuff, Krantz, & McClannahan, 1993).

When implementing least-to-most prompting, the parent or instructor waits for the child to perform the behavior before providing a prompt; the prompting hierarchy moves from least to most intrusive (Cihak, Fahrenkrog, Ayres, & Smith, 2010; Kroeger, Schultz, & Newsom, 2007; Murzynski & Bourret, 2007). A set amount of time is usually given to the learner to do so after the presentation of the social cue (e.g., 3 s). For example, an instructor may say, “hi” and wait 3 s for the child to respond. If the child does not respond correctly, the instructor may provide a subtle gesture as a prompt (e.g., waving) and wait again for a response. After an additional 3 s, the instructor may provide a more intrusive prompt such as a verbal cue or physical guidance to wave. Once the child performs the social behavior correctly, the instructor provides a reinforcer and continues teaching. Jolly, Center, Test, and Spooner (1993) used role-play to teach social skills to children with ASD and integrated a least-to-most prompting procedure to facilitate engagement in correct responding. In a recent example, Davis-Temple, Jung, and Sainato (2014) implemented a four-step least-to-most prompting hierarchy to teach three children with special needs to play social board games. The hierarchy involved an indirect verbal prompt, a direct verbal prompt, a gestural or model prompt, and a physical prompt. Both

the previous studies are examples of how least-to-most prompting strategies may be implemented to support children in the development of their social skills.

Finally, time delay refers to the amount of time that the instructor provides between the presentation of the social request and the prompt (Yilmaz & Birkan, 2005). Instructors can implement the delay in a constant or progressive manner. For the constant time delay, the prompt is presented after a specific amount of time (e.g., 3 s). For the progressive time delay procedure, the instructor starts by presenting the prompt simultaneously with the social stimulus. The time delay is then systematically increased by 1 s at a time following the child's progression. Time delay procedures have been shown to be effective in teaching social and communication skills within children's natural environments (Liber, Frea, & Symon, 2008; Yilmaz & Birkan, 2005). For children with ASD or other disabilities, this contextual teaching may promote generalization of social skills across individuals and settings.

Stimulus fading and stimulus shaping are fading procedures that are implemented by modifying the discriminative stimulus presented to the child (Wolery & Gast, 1984). When implementing stimulus fading, the parent or instructor introduces a new stimulus with enhanced characteristics to increase the likelihood of an errorless response (e.g., Lancioni, 1983). Then, the altered characteristics (e.g., colour, size, shape) is faded by the instructor. For stimulus shaping, relevant dimensions of a stimulus that already evokes the target behavior are gradually modified until the child responds correctly following the presentation of the natural social stimulus only. Krantz and McClannahan (1998) used a script fading procedure to teach three boys aged 4 and 5 with autism to interact with an

adult by saying, “Look” and “Watch me”. First, the instructor showed the children a card with the word scripted on it. Then, the instructor removed one third of the card at every step until no card was visible. The script fading procedure was effective in increasing child-adult social interactions for the three boys and its effects also generalized to a new adult. As discussed earlier, Taylor and Hoch (2008) used fading with intra-stimulus prompts to bring a social response under the control of naturally occurring social stimuli; that is, they reduced the salience of an adult’s pointing when teaching children to respond to this social cue.

Chaining

Chaining involves teaching a complex behavior, which has been divided into many simpler ones within a chain of behaviors. Every behavior within the chain is reinforced and serves as a cue for the subsequent behavior of the sequence. In other words, the feedback provided from one behavior functions as the discriminative stimulus for the subsequent one. As for the first and the last unit of the chain, they serve only one function, either the discriminative stimulus or reinforcer. Chaining is a validated procedure to teach self-help, adaptive, community, and domestic skills to children (Rayner, 2011; Shrestha, Anderson, & Moore, 2012; Thomson, Walters, Martin, & Yu, 2011). Moreover, Odom, Collet-Klingenberg, Rogers, & Hatton (2010) performed a review of evidence-based intervention in children and youth with ASD and indicated that task analysis and chaining had accumulated enough empirical support to be considered as evidence-based practices in teaching communication, play, and social skills.

Before implementing chaining procedures, a task analysis must be developed and validated. Once the complex behavior is divided into a chain, the skills of the child are assessed and the instructor selects one of the four chaining methods: forward, total-task, backward, or backward with leap-ahead (Cooper et al., 2007). Forward chaining consists of initially teaching the first behavior of the chain and then every subsequent unit in a sequential order. To clarify this principle, let's use the simple behavior of brushing teeth. The first step to be taught would be "open the toothpaste". After the child has shown acquisition of the first step, the behavior "apply toothpaste on toothbrush" could be taught and so on, until every behavior of the chain was mastered. DeQuinzio, Townsend, and Poulson (2008) showed that forward chaining with contingent social interaction was effective at teaching a sharing response chain to four children with ASD. In another study, Libby, Weiss, Bancroft, and Ahearn (2008) compared two prompting techniques to teach play skills with forward chaining to five children with ASD and other disabilities. Their results indicated that forward chaining led to play skills acquisition, regardless of the prompting procedure.

Total-task chaining represents a variation of forward chaining in which the instructor teaches every unit of the chain at each training session until the child is able to accomplish the entire sequence. One example of an intervention that takes advantage of total-task chaining is video modeling. During video modeling, all the components of complex social behaviors are taught simultaneously within the recording, which is a form of total-task chaining (Kagohara et al., 2013; Tetreault & Lerman, 2010). Similarly, Arntzen, Halstadtrø, and Halstadtrø (2003) taught a child with developmental disability

to play appropriately by teaching all steps that he performed incorrectly simultaneously. Specifically, the instructor provided prompts on steps performed incorrectly during a previous trial.

Backward chaining consists of teaching the last step of a chain and then introducing every unit of the chain in a reversed sequential order. Using our earlier example of brushing teeth, putting away the toothpaste and toothbrush could be the first behavior taught and after successfully meeting the mastery criterion for this step, rinsing the toothbrush (i.e., the second to last step) could be introduced, until the first unit of the chain was mastered. In backward chaining, the reinforcer is always provided at the end of the chain. Backwards chaining with leap-ahead is essentially the same process as backward chaining except that one would not teach every step of the chain because the child may have already mastered some units. Rather, the mastered steps can be probed while teaching the rest of the chain (Spooner, Spooner, & Ulicny, 1986). Backward chaining is part of the picture exchange communication system (PECS), a widely used program to teach social communication to children with developmental disabilities (Bondy & Frost, 1994). For example, Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002) taught children with ASD to initiate communication spontaneously using PECS. The initial step of the program, the exchange, is taught using backward chaining. The behavior of giving a picture to the instructor can be divided into tree steps: 1) pick up the card, 2) move hand over the instructor's hand, and 3) let go of the card. The instructor physically prompts the two first steps, and then the child must release the card without prompting. When this behavior meets the mastery criterion, the instructor prompts only

the first step; the child then has to perform the last two independently. Research on PECS suggests that backward chaining may be useful to teach basic social communication skills to children with developmental disabilities.

Shaping

Shaping is a procedure used to teach a behavior that is not yet in a person's behavioral repertoire and consists of reinforcing the nearest approximation of the target behavior (Cooper et al., 2007). The shaping procedure contains two components: differential reinforcement and successive approximations. The procedure involves the differential reinforcement of behaviors that share some characteristics with the target behavior while withholding reinforcement for other behaviors. In doing so, the occurrence of the desirable behavior is likely to increase. The first step of shaping consists of identifying a behavior already in the repertoire of the person that shares some characteristics with the target behavior (nearest approximation) and providing reinforcement contingent on its occurrence. When the occurrence of the initial approximation increases, the instructor modifies the criteria and reinforces a novel approximation closer to the final behavior. Successive approximations refer to this progressive change in reinforcement criteria. In shaping attending behavior, the instructor could reinforce the child when the head is up. When the occurrence of this behavior increases, the instructor could then reinforce when the child makes eye contact, and then when the child's responds to the instructor's question.

As with other behavioral procedures, shaping is often integrated into comprehensive intervention programs (Lovaas, 2003; Rogers, 2000). Shaping may also

represent a core intervention strategy within a program. Allen et al. (1964) showed that shaping was effective to teach social play to a preschool girl who had a low rate of social interactions. Another study demonstrated shaping as an effective technique for increasing peer-to-peer interactions for children who were socially withdrawn, but that modeling appeared to be more effective (O'Connor, 1972). In a more recent example, Hall, Maynes, and Reiss (2009) used shaping with overcorrection to improve eye contact in children with Fragile X syndrome. The instructor only reinforced increasingly longer durations (i.e., approximations) of eye contact using percentile schedules. As such, shaping contributed to increasing the duration of eye contact, an essential nonverbal social behavior. One of the benefits of implementing shaping procedures is that it may reduce frustration by reinforcing already mastered behaviors (Lovaas, 2003). That said, using shaping to teach novel social behavior may be time consuming when compared to other strategies (e.g., prompting); it should mainly be used when it is not possible to prompt the behavior (e.g., vocal behavior, eye contact) or the person is unable to execute the correct behavior despite prompting.

Discrete Trial Training

Discrete trial training is a format used to teach a variety of skills to children such as communication, play, social, self-help, and academics (Hayward, Gale, & Eikeseth, 2009; Smith, 2001). Typically, discrete trial training includes five distinct parts: 1) a discriminative stimulus provided by the instructor, 2) a prompt to help the child emit the target behavior, 3) the child’s response, 4) a consequence (reinforcing a correct response or implementing an error correction procedure in the case of an incorrect answer), and 5)

a brief pause before presenting the discriminative stimulus for the next trial. Discrete trial training is typically applied within one-to-one teaching sessions between an instructor and a child.

Downs, Downs, Johansen, and Fossum (2007) showed that discrete trial training brought positive change in social-emotional and adaptive behaviors in young children with developmental disabilities. In addition, Nuzzolo-Gomez, Leonard, Ortiz, Rivera, and Greer (2002) demonstrated that discrete trial training combined with reinforcement could increase engagement in appropriate functional play in preschoolers with ASD. In a review study, Odom, et al. (2010) indicated that discrete trial training was considered evidence-based in teaching new behaviors and communication skills, but that it did not have sufficient support to be considered an evidence-based practice when teaching social skills to children with ASD.

Lovaas (2003) presented four reasons to use discrete trial training: 1) the nature of the teaching format helps the children access the discriminative stimulus, 2) it is easy to observe when a child responds correctly, 3) it allows the instructor to teach with consistency, and 4) it facilitates data collection to assess progress. The opportunity to implement this teaching format in a large range of contexts also represents an advantage (Downs et al., 2007). Although discrete trial training is an efficient teaching format, some limitations should be considered. Given the structured nature of this method, Smith (2001) indicated that children may fail to respond in the absence of a clear discriminative stimulus. To address this issue, practitioners should implement a more flexible instructional approach after the child has met the mastery criterion.

Reinforcement Schedules

As with any other type of behavior, reinforcement is generally an essential component of social skills training. With some children, the social reinforcement provided by the continued interaction with others may be insufficient to teach novel behaviors, which is why adding other types of reinforcers may be important (Reichow, Steiner, & Volkmar, 2013). Ratio-based schedules involve the delivery of a reinforcer after the child has emitted the behavior for a pre-specified number of times (Catania, 2013). This delivery can occur after a fixed number of responses or a variable number of responses. When the reinforcer is provided every time the behavior occurs, the schedule is referred to as continuous reinforcement. For example, Russo and Koegel (1977) taught a young girl with ASD social skills in the classroom by providing tokens every time she emitted specific skills; she could accumulate tokens that she later exchanged for back up reinforcers (e.g., edible items). Intermittent ratio schedules, wherein the reinforcement is provided after a fixed or variable of response, is often used to promote maintenance of behavior over time (Beiers, Derby, & McLaughlin, 2016; Hopkins, 1968; Martins & Harris, 2006).

In contrast, interval-based schedules involve the delivery after a variable or fixed period of time or for the first response that occurs after the interval (Catania, 2013). In a recent example, Vallinger-Brown and Rosales (2014) taught basic conversational skills (i.e., intraverbal responding) to children with attention deficit disorder. The instructor provided reinforcement for attending on a 30-s variable interval schedule and responses during post-test were also reinforced with on 1-min variable interval schedule using

tokens as reinforcers. As a variation of the variable-interval schedule, Matson, Fee, Coe, and Smith (1991) implemented a procedure whereby an instructor provided edible reinforcers to children with developmental delay if they had engaged in the behavior when a timer beeped on a variable 4-min schedule. This procedure increased social play for two of three participants. We recommend interval-based schedules when the target social behavior may have a variable duration (e.g., play, maintaining a conversation); using ratio-based schedules may result in briefer social responses as the child may attempt to maximize reinforcement (i.e., engage in shorter, but more frequent bouts of the behavior to meet the reinforcement requirement more rapidly), which may be counterproductive.

Finally, lag schedules are often reported in studies of social skills, particularly in the acquisition of play. Lag schedules involve reinforcing the variability of a behavior (Page & Neuringer, 1985). For example, a lag 5 schedule involves the reinforcement of a response only if five consecutive responses differ from one another. Baruni, Rapp, Lipe, and Novotny (2014) taught children with intellectual disability to vary play behavior by implementing lag 1 and lag 2 schedules. Interestingly, the lag 2 schedule did not significantly increase variability when compared to the lag 1 schedule for two of three participants. Using a combination of lag and interval schedules, Lepper, Devine, and Petursdottir (2016) used lag 1 and 2 schedules to teach varying conversational topics in two children with ASD. Specifically, the conversational partner provided attention if the topic differed from the topics discussed in the previous one or two 10-s intervals.

Generalization Training

Generalization is the process whereby children display learned behavior within novel stimulus conditions or show novel responses under stimulus conditions in which a similar response was previously reinforced (Catania, 2013). For example, a child who learns to say “hi” to a relative and then applies the same behavior to an instructor (without prior reinforcement or prompting) is said to have shown stimulus generalization. Similarly, a child who learns to hold a conversation about cars and then applies this new skill to discussing planes is displaying response generalization. A child may show generalization to novel persons, settings, contexts or responses. Long-term maintenance of skills is also a form of generalization but across time. Generalization is not necessarily a passive process and should thus be actively programmed when teaching social skills to children (Chandler et al., 1992).

In a seminal paper on generalization, Stokes and Baer (1977) described seven proactive strategies to promote generalization. Researchers have incorporated each of these strategies in prior studies examining the effects of social skills training in children (Chandler et al., 1992). The first strategy, introducing natural maintaining contingencies, involves the use of contingencies that maintain themselves in the child’s typical environment. Probably the best example of natural contingencies for social play is the use of peers during training because the consequences provided by these peers are the same as those that the child will contact when emitting the behavior in the natural environment. For example, Laushey and Heflin (2000) implemented a buddy system for two children with ASD. The teacher instructed peers to stay, play, and talk with both children. The

contingencies in the training environment (i.e., receiving social reinforcement through continued interaction) were the same as the ones present in the natural environment (e.g., classroom, recess), which made it more likely that the children would show generalization.

A second strategy to promote generalization is to teach sufficient exemplars for the child to display the behavior to untaught exemplars. A practitioner may train the behavior with multiple persons, in many settings, or with different materials (e.g., toys) in order to increase the likelihood of the learned behavior being emitted in novel stimulus conditions. To promote generalization of helping behavior, Reeve, Reeve, Townsend, and Poulson (2007) taught multiple exemplars of helping by varying the teaching materials with four children with ASD. Their results indicated that teaching using multiple exemplars was effective in promoting multiple forms of generalization. In an interesting variation of the peer buddy system, Gunter, Fox, Brady, Shores, and Cavanaugh (1988) systematically introduced three different peers to teach social skills to two children with ASD. Both children increased appropriate responding to training peers and one participant showed generalization to peers outside training. In addition to representing the use naturally occurring contingences (as discussed previously), this study also demonstrates the method of teaching sufficient exemplars by varying the peers used.

Third, practitioners may program for generalization by training loosely; that is, the instructor exerts less control over the stimulus conditions used during training. During this type of training, the child has the opportunity to contact the contingencies under various stimulus conditions, which encourages responding in the presence of novel

stimuli. In other words, training loosely is similar to teaching sufficient exemplars, except that the instructor does not systematically control the introduction of exemplars. La Greca and Santogrossi (1980) developed groups to teach social skills to children without disability using modeling, coaching, and role-play. The results showed that the children receiving the intervention showed more social initiations in the classroom. The intervention can be conceptualized as an example of training loosely because the instructors exerted little control over the exemplars produced during role-play in the group context and over the questions that arose from the participants. In a more recent example, McMahon, Vismara, and Solomon (2013) incorporated unstructured play time within their social skills training program, which could promote generalization through the training loosely strategy.

To promote generalization over time, one of the most common strategies is the use of indiscriminable contingencies. These contingencies involve the delivery of intermittent reinforcement schedules, which have been repeatedly shown to be more resistant to extinction than continuous reinforcement (Lerman, Iwata, Shore, & Kahng, 1996; MacDonald, Ahearn, Parry-Cruwys, Bancroft, & Dube, 2013). To teach cooperative play to three children with intellectual disability, Lancioni (1982) showed that continuous edible reinforcement was initially necessary, but that gradually thinning the schedule to a variable ratio promoted the generalization of the skills. Likewise, Martins and Harris (2006) initially used continuous reinforcement schedule to teach joint attention initiations to three children with ASD. Once each child had mastered the skill,

the researchers changed to variable-ratio schedules, which should promote both generalization and maintenance at follow-up.

A fifth strategy is to include stimuli common to both the training and natural environments. Programming common stimuli is a relatively simple strategy to promote generalization: The instructor only needs to make the training environment as similar as possible to the context in which the child is expected to display the social skill. One common strategy to program common stimuli is to include peers in the environment such as in peer-mediated treatments discussed earlier. In an interesting example, Beiers et al. (2016) taught a coach to prompt and reinforce appropriate social interactions during hockey practices. In this case, the prompting and reinforcement was delivered by the same person and in the presence of the same peers as in the natural environment. The intervention effectively increased social interactions of both participants. Moreover, the procedures also increased the likelihood that the new learned skills would continue when the procedures were faded. Another strategy is to conduct the training in the environment in which the skills will be used. To this end, multiple studies have shown that conducting training in schools may promote the generalization of learned social skills (Bellini, Peters, Benner, & Hopf, 2007).

Children can also be taught to mediate their own generalization to promote the use of social skills in novel contexts. Mediation takes on multiple forms in the research literature. Notably, Alber and Heward (2000) recommend teaching students to recruit attention in the form of praise when using social skills appropriately, which could promote generalization. In a variation, Hagopian, Kuhn, and Strother (2009) taught

children to recruit attention to reduce inappropriate social behavior; the results showed that the intervention was effective, but the researchers did not measure generalization of the new skill. Another method of promoting generalization through mediation is to provide homework or handouts following social skills training sessions in order to prompt the child to practice the skill in other contexts (La Greca & Santogrossi, 1980; Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012; Ollendick & Hersen, 1979). Self-monitoring is an alternative form of mediation, which involves recording the frequency that the skill was used outside the training setting (Ivy et al., 2016; Morrison, Kamps, Garcia, & Parker, 2001; Warrenfeltz et al., 1981).

Finally, generalization can be conceptualized as an operant that can be reinforced as any other behavior. This strategy is typically referred to as "train to generalize" (Stokes & Baer, 1977). For example, Lang et al. (2014) taught children with ASD to play using lag schedules of reinforcement. The intervention involved the reinforcement of novel or different responses (i.e., response generalization) in order to increase variability in play and thus facilitate social integration. Another strategy can be to have parents to deliver reinforcement in the natural environment. In a study incorporating this strategy, Pfiffner and McBurnett (1997) taught parents of children with attention deficit disorder to provide social and token reinforcement for displaying learned social skills at home. In both previous examples, generalization was reinforced as an operant, which should encourage responding under novel stimulus conditions or the production of novel responses.

As with other behavior analytic methods, these seven strategies are not mutually exclusive. As an illustration, the peer buddy system is often a combination of naturally occurring contingencies, programming common stimuli, and multiple exemplars. Similarly, lag schedules of reinforcement are examples of both the indiscriminable contingencies and the train to generalize strategies. Practitioners should also note that the research literature does not currently indicate whether one strategy is better than others. Therefore, we encourage practitioners to combine multiple strategies together.

Conclusions

In sum, several social skills training procedures have been derived from behavior analytic principles. Most of these strategies have not been tested individually, but are rather part of broader intervention packages. Given that the principles of behavior analysis should apply to most behaviors regardless of their topography, the results of studies using these interventions provide sufficient support to be confident that they can also be effective alone or in combination with other interventions to improve social skills training. Social skills behavioral training generally involves prompts and reinforcement procedures, and may also include other behavior analytic strategies (Spence, 2003). As general guidelines, we recommend that practitioners always conduct an assessment prior to the implementation of social skills intervention and collect data to monitor its effects. When designing treatments, practitioners should also consider combining multiple procedures within social skills programs as is often done in group training and peer-mediated interventions. Last, generalization should not be expected to occur on its own following training, but should rather be actively programmed. Ultimately, researchers and

practitioners alike should take advantage of behavior analytic methods and research when implementing social skills assessments and interventions with children.

References

Alber, S. R., & Heward, W. L. (2000). Teaching students to recruit positive attention: A review and recommendations. *Journal of Behavioral Education, 10,* 177-204. doi: 10.1023/A:1012258231074

Allen, K. E., Hart, B., Buell, J. S., Harris, F. R., & Wolf, M. M. (1964). Effects of social reinforcement on isolate behavior of a nursery school child. *Child Development, 35,* 511-518. doi:10.2307/1126714

Arntzen, E., Halstadtrø, A.-M., & Halstadtrø, M. (2003). Training play behavior in a 5-year-old boy with developmental disabilities. *Journal of Applied Behavior Analysis, 36,* 367-370. doi:10.1901/jaba.2003.36-367

Barton, E. E., & Wolery, M. (2008). Teaching pretend play to children with disabilities: A review of the literature. *Topics in Early Childhood Special Education, 28,* 109-125. doi:10.1177/0271121408318799

Baruni, R. R., Rapp, J. T., Lipe, S. L., & Novotny, M. A. (2014). Using lag schedules to increase toy play variability for children with intellectual disabilities. *Behavioral Interventions, 29,* 21-35. doi:10.1002/bin.1377

Beiers, K., Derby, K. M., & McLaughlin, T. F. (2016). Increasing social interactions using prompts and rewards for adolescents with asd in an ice hockey practice context. *Educational Research Quarterly, 39,* 40-56.

Bellini, S., Peters, J. K., Benner, L., & Hopf, A. (2007). A meta-analysis of school-based social skills interventions for children with autism spectrum disorders. *Remedial and Special Education, 28,* 153-162. doi: 10.1177/07419325070280030401

Bondy, A. S., & Frost, L. A. (1994). The picture exchange communication system. *Focus on Autism and Other Developmental Disabilities, 9*, 1-19. doi:10.1177/108835769400900301

Brown, J. L., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (2008). Using script fading to promote natural environment stimulus control of verbal interactions among youths with autism. *Research in Autism Spectrum Disorders, 2*, 480-497. doi:10.1016/j.rasd.2007.08.006

Bryan, L. C., & Gast, D. L. (2000). Teaching on-task and on-schedule behaviors to high-functioning children with autism via picture activity schedules. *Journal of Autism and Developmental Disorders, 30*, 553-567. doi:0162-3257/00/1200-0553$18.00/0

Catania, A. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

Chandler, L. K., Lubeck, R. C., & Fowler, S. A. (1992). Generalization and maintenance of preschool children's social skills: A critical review and analysis. *Journal of Applied Behavior Analysis, 25*, 415-428. doi:10.1901/jaba.1992.25-415

Charlop-Christy, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the picture exchange communication system (pecs) with children with autism: Assessment of pecs acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis, 35*, 213-231. doi: 10.1901/jaba.2002.35-213

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of*

Autism and Developmental Disorders, 30, 537-552. doi:0162-3257/00/1200-0537$18.00/0

Chebli, S. S., & Lanovaz, M. J. (2016). Using computer tablets to assess preference for videos in children with autism. *Behavior Analysis in Practice, 9*, 50-53. doi:10.1007/s40617-016-0109-0

Cihak, D., Fahrenkrog, C., Ayres, K. M., & Smith, C. (2010). The use of video modeling via a video ipod and a system of least prompts to improve transitional behaviors for students with autism spectrum disorders in the general education classroom. *Journal of Positive Behavior Interventions, 12*, 103-115. doi:10.1177/1098300709332346

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson Education.

Cowan, R. J., & Allen, K. D. (2007). Using naturalistic procedures to enhance learning in individuals with autism: A focus on generalized teaching within the school setting. *Psychology in the Schools, 44*, 701-715. doi:10.1002/pits.20259

Davis-Temple, J., Jung, S., & Sainato, D. M. (2014). Teaching young children with special needs and their peers to play board games: Effects of a least to most prompting procedure to increase independent performance. *Behavior Analysis in Practice, 7*, 21-30. doi:10.1007/s40617-014-0001-8

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29*, 519-533. doi:10.1901/jaba.1996.29-519

DeQuinzio, J. A., Townsend, D. B., & Poulson, C. L. (2008). The effects of forward chaining and contingent social interaction on the acquisition of complex sharing responses by children with autism. *Research in Autism Spectrum Disorders, 2*, 264-275. doi:10.1016/j.rasd.2007.06.006

Doll, C., McLaughlin, T. F., & Barretto, A. (2013). The token economy: A recent review and evaluation. *International Journal of Basic and Applied Science, 2*, 131-149.

Downs, A., Downs, R. C., Johansen, M., & Fossum, M. (2007). Using discrete trial teaching within a public preschool program to facilitate skill development in students with developmental disabilities. *Education and Treatment of Children, 30*, 1-27. doi: 10.1353/etc.2007.0015

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*, 491-498. doi:10.1901/jaba.1992.25-491

Frea, W. D., & Hughes, C. (1997). Functional analysis and treatment of social-communicative behavior of adolescents with developmental disabilities. *Journal of Applied Behavior Analysis, 30*, 701-704. doi:10.1901/jaba.1997.30-701

Graetz, J. E., Mastropieri, M. A., & Scruggs, T. E. (2006). Show time: Using video self-modeling to decrease inappropriate behavior. *Teaching Exceptional Children, 38*, 43-48. doi:10.1177/004005990603800506

Graff, R. B., & Karsten, A. M. (2012). Assessing preferences of individuals with developmental disabilities: A survey of current practices. *Behavior Analysis in Practice, 5*, 37-48.

Gresham, F. M., & Elliott, S. N. (1984). Assessment and classification of children's social skills: A review of methods and issues. *School Psychology Review, 13*, 292-301.

Gunter, P., Fox, J. J., Brady, M. P., Shores, R. E., & Cavanaugh, K. (1988). Nonhandicapped peers as multiple exemplars: A generalization tactic for promoting autistic students' social skills. *Behavioral Disorders, 13*, 116-126.

Hagiwara, T., & Myles, B. S. (1999). A multimedia social story intervention: Teaching skills to children with autism. *Focus on Autism and Other Developmental Disabilities, 14*, 82-95. doi: 10.1177/108835769901400203

Hagopian, L. P., Kuhn, D. E., & Strother, G. E. (2009). Targeting social skills deficits in an adolescent with pervasive development disorder. *Journal of Applied Behavior Analysis, 42*, 907-911. doi: 10.1901/jaba.2009.42-907

Hagopian, L. P., Long, E. S., & Rush, K. S. (2004). Preference assessment procedures for individuals with developmental disabilities. *Behavior Modification, 28*, 668-677. doi:10.1177/0145445503259836

Hagopian, L. P., Rush, K. S., Lewin, A. B., & Long, E. S. (2001). Evaluating the predictive validity of a single stimulus engagement preference assessment. *Journal of Applied Behavior Analysis, 34*, 475-485. doi:10.1901/jaba.2001.34-475

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. doi:10.1901/jaba.2009.42-171

Haring, T. G., Kennedy, C. H., Adams, M. J., & Pitts-Conway, V. (1987). Teaching generalization of purchasing skills across community settings to autistic youth using videotape modeling. *Journal of Applied Behavior Analysis, 20,* 89-96. doi: 10.1901/jaba.1987.20-89

Harrell, L. G., Kamps, D., & Kravits, T. (1997). The effects of peer networks on social-communicative behaviors for students with autism. *Focus on Autism and Other Developmental Disabilities, 12,* 241-256. doi:10.1177/108835769701200406

Hayward, D. W., Gale, C. M., & Eikeseth, S. (2009). Intensive behavioural intervention for young children with autism: A research-based service model. *Research in Autism Spectrum Disorders, 3,* 571-580. doi:10.1016/j.rasd.2008.12.002

Hopkins, B. L. (1968). Effects of candy and social reinforcement, instructions, and reinforcement schedule leaning on the modification and maintenance of smiling. *Journal of Applied Behavior Analysis, 1,* 121-129. doi:10.1901/jaba.1968.1-121

Horrocks, E., & Higbee, T. S. (2008). An evaluation of a stimulus preference assessment of auditory stimuli for adolescents with developmental disabilities. *Research in Developmental Disabilities, 29,* 11-20. doi:10.1016/j.ridd.2006.09.003

Hurl, K., Wightman, J., Haynes, S. N., & Virues-Ortega, J. (2016). Does a pre-intervention functional assessment increase intervention effectiveness? A meta-

analysis of within-subject interrupted time-series studies. *Clinical Psychology Review, 47*, 71-84. doi:10.1016/j.cpr.2016.05.003

Ivy, S. E., Lather, A. B., Hatton, D. D., & Wehby, J. H. (2016). Toward the development of a self-management intervention to promote pro-social behaviors for students with visual impairment. *The Journal of Special Education*. Advanced online publication. doi:10.1177/0022466916630961

Jolly, A. C., Center, S. M., Test, D. W., & Spooner, F. (1993). Using badges to increase initiations of children with severe disabilities in a play setting. *Research and Practice for Persons with Severe Disabilities, 18*, 46-51. doi:10.1177/154079699301800107

Jones, E. A. (2009). Establishing response and stimulus classes for initiating joint attention in children with autism. *Research in Autism Spectrum Disorders, 3*, 375-389. doi:10.1016/j.rasd.2008.08.004

Kagohara, D. M., Achmadi, D., van der Meer, L., Lancioni, G. E., O'Reilly, M. F., Lang, R., . . . Sigafoos, J. (2013). Teaching two students with asperger syndrome to greet adults using social stories™ and video modeling. *Journal of Developmental and Physical Disabilities, 25*, 241-251. doi:10.1007/s10882-012-9300-6

Kang, S., O'Reilly, M., Lancioni, G., Falcomata, T. S., Sigafoos, J., & Xu, Z. (2013). Comparison of the predictive validity and consistency among preference assessment procedures: A review of the literature. *Research in Developmental Disabilities, 34*, 1125-1133. doi:10.1016/j.ridd.2012.12.021

Koegel, L. K., Koegel, R. L., Hurley, C., & Frea, W. D. (1992). Improving social skills and disruptive behavior in children with autism through self-management. *Journal of Applied Behavior Analysis, 25*, 341-353. doi:10.1901/jaba.1992.25-341

Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to initiate to peers: Effects of a script-fading procedure. *Journal of Applied Behavior Analysis, 26*, 121-132. doi:10.1901/jaba.1993.26-121

Krantz, P. J., & McClannahan, L. E. (1998). Social interaction skills for children with autism: A script-fading procedure for beginning readers. *Journal of Applied Behavior Analysis, 31*, 191-202. doi:10.1901/jaba.1998.31-191

Kroeger, K. A., Schultz, J. R., & Newsom, C. (2007). A comparison of two group-delivered social skills programs for young children with autism. *Journal of Autism and Developmental Disorders, 37*, 808-817. doi:10.1007/s10803-006-0207-x

La Greca, A. M., & Santogrossi, D. A. (1980). Social skills training with elementary school students: A behavioral group approach. *Journal of Consulting and Clinical Psychology, 48*, 220-227. doi:10.1037/0022-006X.48.2.220

Lancioni, G. E. (1982). Normal children as tutors to teach social responses to withdrawn mentally retarded schoolmates: Training, maintenance, and generalization. *Journal of Applied Behavior Analysis, 15*, 17-40. doi:10.1901/jaba.1982.15-17

Lancioni, G. E. (1983). Using pictorial representations as comunication means with low-functioning children. *Journal of Autism and Developmental Disorders, 13*, 87-105. doi:10.1007/BF01531362

Lang, R., Machalicek, W., Rispoli, M., O'Reilly, M., Sigafoos, J., Lancioni, G., … Didden, R. (2014). Play skills taught via behavioral intervention generalize, maintain, and persist in the absence of socially mediated reinforcement in children with autism. *Research in Autism Spectrum Disorders, 8,* 860-872. doi:10.1016/j.rasd.2014.04.007

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis, 36,* 407-414. doi:10.1901/jaba.2003.36-407

Laugeson, E. A., Frankel, F., Gantman, A., Dillon, A. R., & Mogil, C. (2012). Evidence-based social skills training for adolescents with autism spectrum disorders: The ucla peers program. *Journal of Autism and Developmental Disorders, 42,* 1025-1036. doi:10.1007/s10803-011-1339-1

Laushey, K. M., & Heflin, L. J. (2000). Enhancing social skills of kindergarten children with autism through the training of multiple peers as tutors. *Journal of Autism and Developmental Disorders, 30,* 183-193. doi: 10.1023/A:1005558101038

Lepper, T. L., Devine, B., & Petursdottir, A. I. (2016). Application of a lag contingency to reduce perseveration on circumscribed interests. *Developmental Neurorehabilitation* Advanced online publication. doi:10.3109/17518423.2016.1152612

Lerman, D. C., Iwata, B. A., Shore, B. A., & Kahng, S. (1996). Responding maintained by intermittent reinforcement: Implications for the use of extinction with problem

behavior in clinical settings. *Journal of Applied Behavior Analysis, 29*, 153-171. doi:10.1901/jaba.1996.29-153

Libby, M. E., Weiss, J. S., Bancroft, S., & Ahearn, W. H. (2008). A comparison of most-to-least and least-to-most prompting on the acquisition of solitary play skills. *Behavior Analysis in Practice, 1*, 37-43.

Liber, D. B., Frea, W. D., & Symon, J. B. (2008). Using time-delay to improve social play skills with peers for children with autism. *Journal of Autism and Developmental Disorders, 38*, 312-323. doi:10.1007/s10803-007-0395-z

Lovaas, O. I. (2003). *Teaching individuals with developmental delays: Basic intervention techniques*. Austin, TX: Pro-Ed.

Maag, J. W. (2005). Social skills training for youth with emotional and behavioral disorders and learning disabilities: Problems, conclusions, and suggestions. *Exceptionality, 13*, 155-172. doi:10.1207/s15327035ex1303_2

MacDonald, J. M., Ahearn, W. H., Parry-Cruwys, D., Bancroft, S., & Dube, W. V. (2013). Persistence during extinction: Examining the effects of continuous and intermittent reinforcement on problem behavior. *Journal of Applied Behavior Analysis, 46*, 333-338. doi:10.1002/jaba.3

MacDuff, G. S., Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to use photographic activity schedules: Maintenance and generalization of complex response chains. *Journal of Applied Behavior Analysis, 26*, 89-97. doi: 10.1901/jaba.1993.26-89

Maione, L., & Miranda, P. (2006). Effects of video modeling and video feedback on peer-directed social language skills of a child with autism. *Journal of Positive Behavior Interventions, 8*), 106-118. doi:10.1177/10983007060080020201

Martins, M. P., & Harris, S. L. (2006). Teaching children with autism to respond to joint attention initiations. *Child & Family Behavior Therapy, 28*, 51-68. doi:10.1300/J019v28n01_04

Matson, J. L., Bamburg, J. W., Cherry, K. E., & Paclawskyj, T. R. (1999). A validity study on the questions about behavioral function (qabf) scale: Predicting treatment success for self-injury, aggression, and stereotypies. *Research in Developmental Disabilities, 20*, 163-175. doi:10.1016/S0891-4222(98)00039-0

Matson, J. L., Fee, V. E., Coe, D. A., & Smith, D. (1991). A social skills program for developmentally delayed preschoolers. *Journal of Clinical Child Psychology, 20*, 428-433. doi:10.1207/s15374424jccp2004_11

Matson, J. L., & Wilkins, J. (2009). Psychometric testing methods for children's social skills. *Research in Developmental Disabilities, 30*, 249-274. doi:10.1016/j.ridd.2008.04.002

McCoy, K., & Hermansen, E. (2007). Video modeling for individuals with autism: A review of model types and effects. *Education and Treatment of Children, 30*, 183-213. doi: 10.1353/etc.2007.0029

McFall, R. M. (1982). A review and reformulation of the concept of social skills. *Behavioral Assessment, 4*, 1-33. doi:10.1007/BF01321377

McMahon, C. M., Vismara, L. A., & Solomon, M. (2013). Measuring changes in social behavior during a social skills intervention for higher-functioning children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 43,* 1843-1856. doi:10.1007/s10803-012-1733-3

Michael, J. (1993). Establishing operations. *The Behavior Analyst, 16*, 191-206.

Morrison, L., Kamps, D., Garcia, J., & Parker, D. (2001). Peer mediation and monitoring strategies to improve initiations and social skills for students with autism. *Journal of Positive Behavior Interventions, 3*, 237-250. doi:10.1177/109830070100300405

Murzynski, N. T., & Bourret, J. C. (2007). Combining video modeling and least-to-most prompting for establishing response chains. *Behavioral Interventions, 22*, 147-152. doi:10.1002/bin.224

Neidert, P. L., Dozier, C. L., Iwata, B. A., & Hafen, M. (2010). Behavior analysis in intellectual and developmental disabilities. *Psychological Services, 7*, 103-113. doi:10.1037/a0018791

Norman, J. M., Collins, B. C., & Schuster, J. W. (2001). Using an instrucional package including video technology to teach self-help skills to elementary students with mental disabilities. *Journal of Special Education Technology, 16*, 5-18. doi:10.1177/016264340101600301

Northup, J., George, T., Jones, K., Broussard, C., & Vollmer, T. R. (1996). A comparison of reinforcer assessment methods: The utility of verbal and pictorial choice

procedures. *Journal of Applied Behavior Analysis, 29*, 201-212. doi:10.1901/jaba.1996.29-201

Nuzzolo-Gomez, R., Leonard, M. A., Ortiz, E., Rivera, C. M., & Greer, R. D. (2002). Teaching children with autism to prefer books or toys over stereotypy or passivity. *Journal of Positive Behavior Interventions, 4*, 80-87. doi:10.1177/109830070200400203

O'Connell, M., Lieberman, L. J., & Petersen, S. (2006). The use of tactile modeling and physical guidance as instructional strategies in physical activity for children who are blind. *Journal of Visual Impairement and Blindness, 100,* 471-477.

O'Connor, R. D. (1972). Relative efficacy of modeling, shaping, and the combined procedures for modification of social withdrawal. *Journal of Abnormal Psychology, 79*, 327-334. doi: 10.1037/h0033226

Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure: Alternative Education for Children and Youth, 54*, 275-282. doi:10.1080/10459881003785506

Odom, S. L., & McConnell, S. R. (1992). Improving social competence: An applied behavior analysis perspective. *Journal of Applied Behavior Analysis, 25*, 239-244. doi: 10.1901/jaba.1992.25-239

Odom, S. L., & Strain, P. S. (1984). Peer-mediated approaches to promoting children's social interaction: A review. *American Journal of Orthopsychiatry, 54*, 544-557. doi:0002-9432/84/040544-14$01.00

Ollendick, T. H., & Hersen, M. (1979). Social skills training for juvenile delinquents. *Behaviour Research & Therapy, 17,* 547-554. doi: 10.1016/0005-7967(79)90098-6

Pace, G. M., Ivancic, M. T., Edwards, G. L., Iwata, B. A., & Page, T. J. (1985). Assessment of stimulus preference and reinforcer value with profoundly retarded individuals. *Journal of Applied Behavior Analysis, 18,* 249-255. doi:10.1901/jaba.1985.18-249

Page, S., & Neuringer, A. (1985). Variability is an operant. *Journal of Experimental Psychology: Animal Behavior Processes, 11,* 429-452. doi:10.1037/0097-7403.11.3.429

Parker, D., & Kamps, D. (2011). Effects of task analysis and self-monitoring for children with autism in multiple social settings. *Focus on Autism and Other Developmental Disabilities, 26,* 131-142. doi:10.1177/1088357610376945

Peca, A., Simut, R., Pintea, S., Costescu, C., & Vanderborght, B. (2014). How do typically developing children and children with autism perceive different social robots? *Computers in Human Behavior, 41,* 268-277. doi:10.1016/j.chb.2014.09.035

Pfiffner, L. J., & McBurnett, K. (1997). Social skills training with parent generalization: Treatment effects for children with attention deficit disorder. *Journal of Consulting and Clinical Psychology, 65,* 749-757. doi:10.1037/0022-006X.65.5.749

Rayner, C. (2011). Teaching students with autism to tie a shoelace knot using video prompting and backward chaining. *Developmental Neurorehabilitation, 14,* 339-347. doi:10.3109/17518423.2011.606508

Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. L. (2007). Establishing a generalized repertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis, 40,* 123-136. doi:10.1901/jaba.2007.11-05

Reichow, B., Steiner, A. M., & Volkmar, F. (2013). Cochrane review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD). *Evidence-Based Child Health: A Cochrane Review Journal, 8,* 266-315. doi:10.1002/ebch.1903

Reichow, B., & Volkmar, F. R. (2010). Social skills interventions for individuals with autism: Evaluation for evidence-based practices within a best evidence synthesis framework. *Journal of Autism and Developmental Disorders, 40,* 149-166. doi:10.1007/s10803-009-0842-0

Resetar, J. L., & Noell, G. H. (2008). Evaluating preference assessments for use in the general education population. *Journal of Applied Behavior Analysis, 41,* 447-451. doi: 10.1901/jaba.2008.41-447

Riley, G. A. (1995). Guidelines for devising a hierarchy when fading response prompts. *Education and Training in Autism and Developmental Disabilities, 30,* 231-242.

Roane, H. S., Vollmer, T. R., Ringdahl, J. E., & Marcus, B. A. (1998). Evaluation of a brief stimulus preference assessment. *Journal of Applied Behavior Analysis, 31,* 605-620. doi:10.1901/jaba.1998.31-605

Rogers, S. J. (2000). Interventions thant facilitate socialization in children with autism. *Journal of Autism and Developmental Disorders, 30*, 399-409. doi: 10.1023/A:1005543321840

Rotatori, A. F., Fox, B., & Switzky, H. (1979). An indirect technique for establishing preferences for categories of reinforcement for severely and profoundly retarded individuals. *Perceptual and Motor Skills, 48,* 1307-1313. doi:10.2466/pms.1979.48.3c.1307

Russo, D. C., & Koegel, R. L. (1977). A method for integrating an autistic child into a normal public-school classroom1. *Journal of Applied Behavior Analysis, 10,* 579-590. doi:10.1901/jaba.1977.10-579

Sarokoff, R. A., Taylor, B. A., & Poulson, C. L. (2001). Teaching children with autism to engage in conversation exchanges: Script fading with embedded textual stimuli. *Journal of Applied Behavior Analysis, 34*, 81-84. doi:10.1901/jaba.2001.34-81

Schipley-Benamou, Lutzker, J. R., & Taubman, M. (2002). each- ing daily living skills to children with autism through instructional video modeling. *Journal of Positive Behavior Interventions, 4*(3), 166-177. doi:10.1177/10983007020040030501

Sherer, M., Pierce, K. L., Paredes, S., Kisacky, K. L., Ingersoll, B., & Schreibman, L. (2001). Enhancing Conversation Skills in Children with Autism Via Video Technology: Which Is Better, "Self" or "Other" as a Model? *Behavior Modification, 25*(1), 140-158. doi:10.1177/0145445501251008

Shreibman, L. (1975). Effects of within-stimulus and extra-stimulus prompting on discrimination learning in autistic children. *Journal of Applied Behavior Analysis, 8*, 91-112. doi: 10.1901/jaba.1975.8-91

Shrestha, A., Anderson, A., & Moore, D. W. (2012). Using point-of-view video modeling and forward chaining to teach a functional self-help skill to a child with autism. *Journal of Behavioral Education, 22*, 157-167. doi:10.1007/s10864-012-9165-x

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and Other Developmental Disabilities, 16*, 86-92. doi: 10.1177/108835760101600204

Spence, S. H. (2003). Social skills training with children and young people: Theory, evidence and practice. *Child and Adolescent Mental Heath, 8*, 84-96. doi:10.1111/1475-3588.00051

Spooner, F., Spooner, D., & Ulicny, G. (1986). Comparison of modified backward chaining: Backward chaining with leap-aheads and reverse chaining with leap-aheads. *Education and Treatment of Children, 9*, 122-134.

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*, 349-367. doi:10.1901/jaba.1977.10-349

Taylor, B. A., & Hoch, H. (2008). Teaching children with autism to respond to and initiate bids for joint attention. *Journal of Applied Behavior Analysis, 41*, 377-391. doi: 10.1901/jaba.2008.41-377

Tetreault, A. S., & Lerman, D. C. (2010). Teaching social skills to children with autism using point-of-view video modeling. *Education & Treatment of Children, 33*, 395-419. doi:10.1353/etc.0.0105

Thomson, K., Walters, K., Martin, G. L., & Yu, C. T. (2011). Teaching adaptive and social skills to individuals with autism spectrum disorders. In J. L. Matson & P. Sturmey (Eds.), *International handbook of autism and pervasive developmental disorders* (pp. 339-354). New York, NY: Springer.

Vallinger-Brown, M., & Rosales, R. (2014). An investigation of stimulus pairing and listener training to establish emergent intraverbals in children with autism. *The Analysis of Verbal Behavior, 30,* 148-159. doi:10.1007/s40616-014-0014-y

Verriden, A. L., & Roscoe, E. M. (2016). A comparison of preference-assessment methods. *Journal of Applied Behavior Analysis, 49*, 265-285. doi:10.1002/jaba.302

Virués-Ortega, J., Pritchard, K., Grant, R. L., North, S., Hurtado-Parrado, C., Lee, M. S. H., . . . Yu, C. T. (2014). Clinical decision making and preference assessment for individuals with intellectual and developmental disabilities. *American Journal On Intellectual And Developmental Disabilities, 119*, 151-170. doi:10.1352/1944-7558-119.2.151

Warrenfeltz, R. B., Kelly, W. J., Salzberg, C. L., Beegle, C. P., Levy, S. M., Adams, T. A., & Crouse, T. R. (1981). Social skills training of behavior disordered adolescents with self-monitoring to promote generalization to a vocational setting. *Behavioral Disorders, 7*, 18-27.

Wolery, M., & Gast, D. L. (1984). Effective and efficient procedures for the transfer of stimulus control. *Topics in Early Childhood Special Education, 4*, 52-77. doi:0271-1214/84/0043-0052

Yilmaz, I., & Birkan, B. (2005). Using a constant time delay procedure to teach aquatic play skills to children with autism. *Education and Training in Autism and Developmental Disabilities*, *40*, 171-182.