

Evaluation of Two Communicative Response Modalities for a Child with Autism and Self-Injury

Stacy E. Danov, Ellie Hartman, Jennifer J. McComas, and Frank J. Symons

Abstract

There is little empirically replicated guidance from the research literature on selecting a communicative response modality when implementing functional communication training (FCT). In this study, two forms of communicative responding (verbal speech and picture cards) were evaluated during functional communication training (FCT) treatment of self-injury for a three-year-old boy with autism. The functional analysis indicated the self-injury was maintained by positive reinforcement in the form of access to preferred items. Findings indicated (a) SIB was eliminated during FCT sessions, and (b) independent picture cards (but not verbal speech) were used in all evaluation sessions. Results are discussed in relation to the clinical issue of choosing among different possible communication response modalities to effectively compete with severe problem behavior.

Keywords: Communication response, Self-Injurious Behavior, Functional communication training, mand selection

Introduction

Severe problem behavior among children with pervasive developmental disorders including autism is relatively prevalent (Horner, Carr, Strain, Todd & Reed, 2002) and costly both to the individual and society (Schroeder, Rojahn, & Oldenquist, 1989). Severe forms of behavior problems such as self-injurious behavior (SIB) or aggression can hinder communicative development and limit verbal and nonverbal communication capacity (National Research Council, 2001).

Behavioral interventions based on the function of the problem behavior have been successfully applied to children with pervasive developmental disorders for a range of problem behaviors including SIB (Carr & Durand, 1985) and aggression (Richman, Wacker, & Winborn, 2001). Identifying a functional relation through analyses designed to expose reinforcement contingencies before treatment increases the likelihood of developing a targeted function-matched intervention to decrease problem behavior and increase adaptive behavior. It is important to identify a behavioral function prior to treatment selection for severe behavioral problems because interventions based on behavioral function are more likely to be effective than arbitrarily chosen interventions (Carr & Durand, 1985; Repp, Felce, & Barton, 1988; Wacker et al., 1998; Wacker et al., 2005).

Among behavioral interventions, functional communication training (FCT) consists of teaching communicative responses such as words, gestures, or signs that are used to effectively compete with problem behavior by producing the same functional reinforcer (Carr, 1988; Wacker et al., 1996). Carr and Durand (1985) demonstrated the power of such an approach with children ($N = 4$) diagnosed with autism by developing a functional assessment tool to identify environmental conditions in which problem behaviors such as aggression, self-injury, and tantrums occurred. The results of the functional assessment were used to define and teach an appropriate replacement behavior with corresponding reductions reported in problem behavior. Wacker et al. have demonstrated consistently (e.g., 1998, 2005) that FCT is highly effective in reducing problem behavior displayed by individuals with developmental disabilities including autism.

Less clear, however, is empirical guidance on selecting the type or form of communicative response to be used during FCT when more than one form (e.g., verbal, gestural) concurrently exists in

the child's repertoire. Recently, Ringdahl et al. (2008) compared two mand topographies (high and low proficiency) during FCT and concluded that FCT was more effective when the high proficiency mand was incorporated into FCT. There are only a limited number of studies, however, explicitly examining the effects of alternative modes of communication on verbal communication in autism and related pervasive developmental disorders. Bondy and Frost (1998) reported that alternative modes of communication do not prohibit the acquisition of verbal behavior, but may actually promote it. They demonstrated that a boy who began training with picture cards began speaking after using the system for 11 months. Eighteen months later his speech replaced the cards as his mode of communication. More recently, Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002) reported an increase in spontaneous and imitative speech following the implementation of picture cards. Further, Ganz and Simpson (2004) found that picture card use was mastered rapidly and word utterances increased in number of words and complexity.

The use of an alternative mode of communication in the form of a mand or request for a functional reinforcer, can also lead to a decrease in problem behavior. Frea, Arnold, and Vittimberga (2001) reported that the problem behavior of a four-year-old boy with autism decreased when he started using the Picture Exchange Communication System. Winborn et al. (2002) showed for two subjects that both existing and novel requests were effective replacements for problem behavior using a concurrent-schedules design, without a reversal or extinction phase. Horner and Day (1991) and Richman, Wacker, and Winborn (2001) demonstrated that when replacing a problem behavior with a request during FCT, response efficiency is important. Problem behavior and requests can be viewed as concurrently available response options, with the goal being to promote the use of the request rather than problem behavior to access reinforcement.

In this single-case study, two communicative response forms (speech, picture cards) were compared during ongoing FCT in which a child with autism was being taught to appropriately request toys and related materials to compete with SIB. Reinforcers and response forms were selected following a functional analysis. Comparisons of the occurrence of SIB and requests were made across both communicative forms using a within-subject ABAB design.

Method

Participant

John was a 3 year 2 day old boy diagnosed with autism. John was previously diagnosed with autism by a licensed psychologist based in the DSM-IV-TR. He received home-based services consisting of Applied Behavior Analysis (ABA) therapy to develop communicative, social, educational and behavioral skills. Reportedly, these services included using a discrete trial method based on individual treatment goals focusing on spoken communication. He participated in approximately 20-30 hours per week consisting of both individual and family skill sessions. The program selection and target goals were determined by parents and trained behavioral professionals. He also attended a pre-school program three days a week. The pre-school or school based program consisted of functional skills and speech and language goals. The frequency (daily/weekly) and intensity of John's self-injury lead to tissue damage and bruising. Forms of self-injury specifically included hitting the front and back of his head to the floor, biting and scratching his forearm, and hitting his forearm to an object. John had limited communication skills. Expressively, he could verbalize single words when prompted, but his articulation was poor and his speech was often difficult to understand. Receptively, he could follow short, one-step directions. At the time of the investigation, he was being introduced to a picture exchange system as part of his school communication program, which was introduced by the teacher and speech practitioner and verbal communication was introduced as part of his home-based behavior therapy program by the behavior therapist.

Procedures

Phase 1: Functional Analysis

General procedure. First, a functional analysis interview (adapted from O’Neil et al., 1997) was conducted with John’s mother and home-based therapist by a graduate research assistant to collect information about the environmental and social events influencing problem behavior. Next, direct observation of the target problem behavior was conducted to clarify and validate the interview findings and gather further information regarding the target problem behavior and the social context in which it occurred. Finally, an experimental (i.e., functional) analysis was conducted at home in John’s therapy room. His mother was coached by a trained graduate research assistant to conduct the functional analysis sessions. Materials used during the functional analysis included puzzles, books, animal toys, a ball, and cards with graphic symbols (cards were used in tasks involving matching 2-D pictures to 3-D items).

The functional analysis used a brief multi-element design to evaluate the influence of social reinforcement contingencies on John’s SIB (Northup et al., 1991). Based on the outcome of the descriptive assessment, two behavioral mechanisms (positive and negative social reinforcement) were tested through three conditions including contingent attention, contingent access to tangibles, and contingent escape from task demand. A control condition in the form of free play was also conducted. During the attention condition, John’s mother sat on the sofa and read a book while John played alone. Approximately 10 s of attention in the form of touching his arm and saying, “Keep your hands down,” was delivered contingent on each occurrence of SIB. During the tangible condition, John had continuous access to his mother’s attention, but access to preferred play items/toys was restricted. Contingent on each occurrence of SIB, John’s mother provided him with 10 s access to the preferred toys. During the escape condition, John’s mother directed him to complete tasks consistent with his ABA therapy program, such as matching items, receptive labeling, puzzles and imitation. Contingent on each occurrence of SIB, the task was removed for 10 s. After 10 s, the task demand was re-presented. During the free play condition John had access to preferred toys and his mother’s attention, and no task demands were delivered. All sessions were 5 min in length and were videotaped.

Dependent measure. Self-injury directed to John’s head was selected as the primary dependent variable based on physician and family concerns. Any instance of hitting the front and back of his head to the floor or wall was recorded (event-count) during the 5-minute session.

Inter-Observer agreement. Twenty-seven percent of the sessions were coded by an independent second observer. Inter-observer agreement (IOA) was calculated by comparing the frequency of the recorded behavior by one observer with that of the second independent observer for the 5-minute session. Percent total agreement was determined by taking the smaller rating and dividing it by the larger rating and the results are multiplying by 100 (Primavera, Allison, & Alfonso, 1997). The mean IOA for SIB was 100%.

Phase 2: Preference Assessment

Procedure. Following the functional analysis, a variation of a multiple stimulus preference assessment with replacement was conducted by a graduate research assistant (Windser et al., 1994) to identify highly preferred play items for use during functional communication training and to verify the items were items he elected to play with. Items he liked to play with were drawn from the same pool of items used in the functional analysis. Items were placed in groups on the table, bookshelves, and on the floor in the room. John was allowed to wander about the room and pick up item. After he selected a toy he was allowed to play with it for as long as he wanted to. At the point in which John was done playing with the toy and he dropped the toy from his hands, the toy was removed, placed back into the items on

the table, bookshelf or floor and the procedure began again. Three sessions were conducted, each lasted approximately 10 min.

Dependent measure. The dependent measure for the multiple stimulus preference assessment with replacement was the duration (seconds) of engagement for each toy for John.

Phase 3: Functional Communication Treatment (FCT)

General procedure. Based on the results of the functional analysis (see below) that suggested John's SIB was reinforced by access to preferred toys, FCT was implemented to teach a communication response as an alternative to SIB (Carr & Durand, 1985). A graduate research assistant taught John to request, both verbally and with picture cards, for preferred toys and items. An ABAB reversal design was used to show the effects of FCT between the two communicative response forms. Session length ranged from 10 to 20 min. At the end of each session, John received a 5-min break with no access to the items used during the request training. The treatment sessions were conducted in John's therapy room at a small picnic table. Items identified in the preference assessment as being highly preferred (i.e., the most number of seconds engaged with) were used in the treatment sessions to increase the likelihood that John would request the items.

Verbal request sessions. The request procedures from Hartman and Klatt (2005) were used. The experimenter sat across the table from John and presented a single item in a counterbalanced order in front of John. The experimenter asked, "What do you want?" A 3 s prompt delay procedure was used to transfer stimulus control from the experimenter's prompt to the presence of the item. In the first trial the experimenter provided an immediate prompt, "(name of item)." After the first trial the verbal prompt was delayed 3 s followed by a prompt "(name of item)." If John gave a correct response (with or without a prompt) John received both verbal praise (e.g., "Good job, you want the (name of the item)") and access to the item for 10 s. If John made an error during a trial or did not respond before the prompt for two consecutive trials, that item was terminated for that trial. In the next trial the experimenter again waited 3 s before giving a prompt. If John responded before or after the question, the response was recorded as an independent correct request. Five consecutive trials for each item were presented in each session. If John turned away from the toy or asked for a different item after the experimenter asked, "What do you want?" the experimenter stopped the trial. If two consecutive trials were stopped, the trials for that item were ended for that session.

Dependent measure. The dependent variable in verbal requesting training was the frequency of independent verbal requests. An independent verbal request was defined as John verbally requesting the item presented by the experimenter (without prompts).

Picture card request sessions. The research assistant sat across the table from John and presented him a picture card board. First, only one picture was presented on the picture board, so that the verbal and picture card procedure would be the same. John requested independently almost immediately, so another card was added to the board. He demonstrated that he could discriminate between the cards, so more cards were added until the picture board was full. The board consisted of pictures of items identified as highly preferred from the preference assessment and other items requested by his mom (e.g., milk). Graphic symbols/icons from Microsoft Clipart of the preferred items were placed on 2 inch by 2 inch note cards that were attached with Velcro onto an 8 by 11 inch pieces cardboard. The cardboard held a total of 12 picture cards. The experimenter asked John, "What do you want?" and placed her hand out for John to place a card into. A 3 s prompt delay procedure was used. In the first trial the experimenter provided an immediate prompt and used hand over hand prompting to have John choose a picture card and place it in the experimenter's hand. After the first trial the physical prompt was delayed 3 s and a verbal prompt was given, ("What do you want?"). If John gave the correct response (with or without a prompt) he received both verbal praise ("Oh you want the (name of the item), good job!") and access to the item for 10 s. John

was able to request any item he asked for, even if it was the same item for the entire time of the session. If SIB occurred during FCT, it was not reinforced. If John verbally requested an item, he was prompted to use the card and then reinforce his behavior, but John did not have any verbal requests during the picture card request sessions.

Dependent measure. The dependent variable for the FCT picture card intervention was the frequency of independent correct picture card requests. An independent correct request was defined as John pulling a picture off of the picture communication board and handing it to someone else without prompts (event-count).

Extinction of picture card. The procedures for this condition were the same as the FCT picture card intervention with a key exception. If John requested with the picture card, he was praised (e.g., “That was a nice way to ask.”) but was not given access to the item (i.e., their use did not produce access to a requested item). John could only receive access to the preferred item if he verbally requested (e.g. said, “Milk”).

Inter-Observer agreement for FCT. Twenty-two percent of the sessions were coded by a second independent observer. IOA was calculated by comparing the frequency of the recorded behavior by one observer with that of the second independent observer for the 5-minute session. Percent total agreement was determined by taking the smaller rating and dividing it by the larger rating and the results are multiplying by 100. The mean IOA for SIB was 100%. The mean IOA for independent requests was 91.5% (Range = 83% -100%).

Treatment integrity. Treatment integrity was calculated for 28% of the treatment sessions randomly selected across all conditions. Treatment integrity was calculated for as a percentage of requests that were followed by access to the tangibles requested. Treatment integrity was 100%.

Results

Phase 1: Brief Functional Analysis

The results of the functional analysis can be seen in Figure 1. The data indicate a differential pattern of SIB responding with elevation during conditions associated with positive reinforcement in the form of contingent access to tangibles (i.e., toys). SIB occurred 10 times during both tangible conditions. SIB either did not occur or occurred at very low frequencies in the other conditions (attention, demand, and control).

Phase 2: Preference Assessment

Results of the preference assessment showed that the duration of engagement with the toys ranged widely and included in descending order: toy sheep (543 s), toy horse (262 s), toy car (159 s), beads (63 s), blocks (60 s), toy chicken (38 s), and toy bus (5 s). Following maternal request, milk was also included as a preferred item accessible during FCT.

Phase 3: Functional Communication Treatment

Results of treatment are shown in Figure 2. When picture cards were available (condition 2, sessions 3-6; condition 4, sessions 9-11; condition 6, sessions 14-15; condition 8, session 18), John independently requested using pictures (approximately 1.5 times per minute). During verbal conditions, a single independent verbal response was made in session 7 and not again in verbal conditions. Following the initial ABABAB evaluation, pictures were put on extinction in sessions 16 and 17. In the picture extinction condition use of pictures did not produce access to a requested item. No corresponding

'crossover' to verbal requesting was observed. During FCT, SIB was observed only during the first verbal FCT condition.

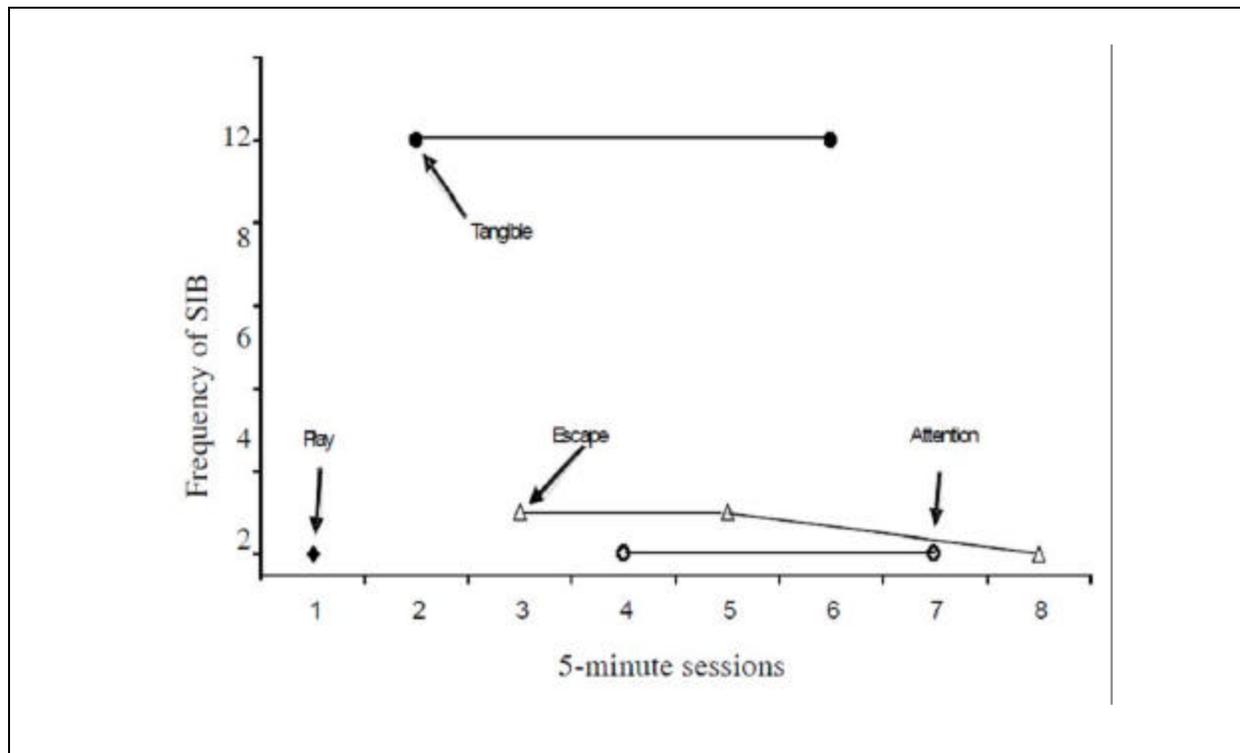
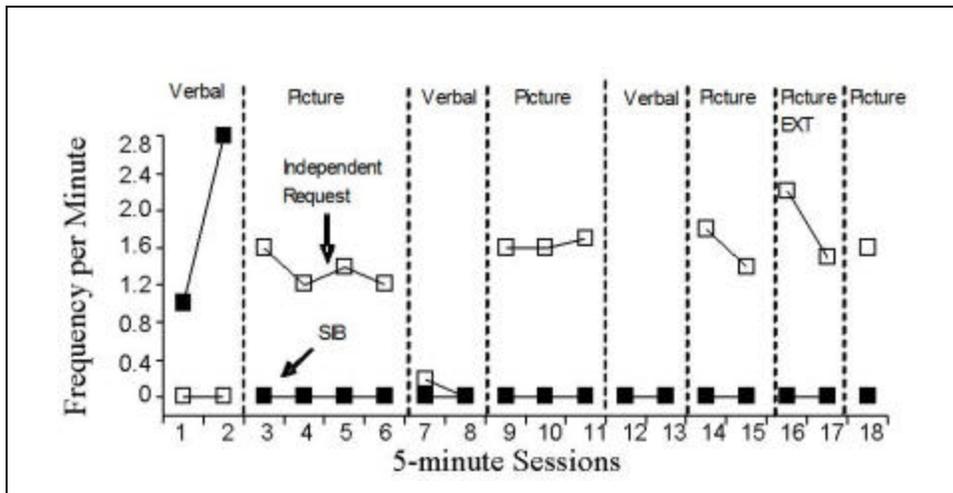


Figure 1. Frequency of self-injurious behavior (SIB) during functional analysis conditions.

Discussion

Severe problem behavior among children with developmental disorders including autism can interfere with communicative development. Identifying the function of the problem behavior can lead to appropriate function-matched targeted interventions that are often communication based. When the child has two or more possible communicative response modalities already in his or her repertoire, no clear guidelines exist for practitioners or parents to choose among them. In this single-case demonstration, two existing communication modalities were directly compared following a functional analysis of self-injury. Overall, the results showed clearly the effectiveness of a picture versus a vocal (i.e., verbal) response modality for this child to request preferred items that competed with and functionally replaced self-injury. Although SIB did not occur after the initial verbal condition, verbal sessions were not associated with any independent requests.



□ = independent requests

■ = SIB (self-injurious behavior)

Note: All independent requests were picture requests; none were verbal.
 During sessions 16 and 17, picture cards were placed on extinction but responding continued to occur exclusively in the form of picture requesting.

Figure 2. Frequency per minute of independent requests and SIB during FCT intervention (verbal and picture requesting training) and extinction trials of picture card.

Because the participant was a clinical referral not selected randomly the results are necessarily limited and are not generalizable to other children his age with autism and SIB or communication difficulties. Because SIB was only observed during the first session, it is impossible to infer that one modality was superior to his SIB. If access to picture cards was removed for longer periods of time, SIB may have reoccurred. It would be predicted that problem behavior would be more likely to occur if a child is required to use a mode of communication that he/she cannot use independently, consistent with Ringdahl et al.'s (2008) recent demonstration. Anecdotally, John appeared more engaged and attentive during picture sessions when compared to verbal sessions. The overall time scale (and therefore the intensity) of the intervention was limited. Past research has reported that over longer intervention periods the acquisition of verbal language may appear during picture card training (Bondy & Frost, 1998; Charlop-Christy et al., 2002).

In addition to response efficiency and reinforcement, another possible reason for the clear differentiation between the picture and verbal communication response options could be related to the structural differences between the instruction sessions themselves that made them nonequivalent. Because the picture board contained many pictures and John could discriminate between the pictures, he was able to select from the full array of cards associated with any toy he may have wanted at the moment. Although, in principle, he could verbally ask for any toy during the verbal request training session, he never made an independent verbal request. Because of this, we 'rotated' through possible preferred toys during verbal instruction sessions, but it remains possible that we were prompting him to request toys that he did not want at the moment. For this reason, we created an extinction condition. Sessions during the

extinction condition allowed John to choose the toy he wanted from the full picture array in which he could see the pictures but was required to use a verbal request for a toy. However, no independent verbal requests occurred during the extinction condition sessions either.

In related areas of clinical research, studies examining picture communication found the picture exchange communication system (PECS) to be effective for teaching functional communication to children with limited speech (Bondy and Frost, 2001; Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet, 2002; Ganz and Simpson, 2004), while studies examining manual signs or total communication found faster receptive and/or expressive vocabulary acquisition than speech alone (Brady & Smouse, 1978; Barrera, Lobato-Barrera, & Sulzer-Azaroff, 1980). Durand (1999) found assistive devices to be effective for communication in recruiting natural communities of reinforcement. Although the present study was not designed to demonstrate the acquisition of different communication modalities per se, the results suggest that picture based requests were more likely to occur and produce a functional reinforcer than verbally based requests at this time for this young boy with autism. Similar to the results reported here, Frea, Arnold and Vittimberga (2001) found that problem behavior was decreased when picture were introduced as a mode of communication for a four year old boy with autism. Winborn et al. (2002) showed that training both novel requests and existing requests can be effective for replacing problem behavior. Additionally, Horner and Day (1991) and Richmand, Wacker, and Winborn (2001) demonstrated that response efficiency is important when replacing a problem behavior with a request during FCT. In this study, it may be that picture cards were a more efficient alternative thereby reducing problem behavior.

The applied behavioral literature on FCT and behavioral problems shows clearly the importance of teaching a replacement behavior (Carr & Durrand, 1985; Wacker et al., 1998). One of the most effective routes for determining what function the replacement behavior should serve is based on conducting a functional analysis prior to beginning intervention (Durand, 1999; Horner et al., 2002). But, determining what form the replacement behavior might take in relation to gains in adaptive behavior and reductions in problem behavior remains a relatively unexplored clinical area in need of further research.

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Author Contact Information

Stacy E. Danov
Department of Educational Psychology
Education Science Building
56 River Road
University of Minnesota
Minneapolis, MN 55455
USA
e-mail: dano0006@umn.edu
Phone: (612) 624-5241

Jennifer McComas
Department of Educational Psychology
Education Science Building
56 River Road
University of Minnesota
Minneapolis, MN 55455
USA
e-mail: jmccomas@umn.edu
Phone: (612) 624-5854

Ellie Hartman
U. of Wisconsin-Stout Vocational Rehab. Institute
Pathways to Independence Projects
Wisconsin Department of Health and Family
Services
1 W Wilson St
Madison, WI 53703-3445
USA
e-mail: hartman.ec@gmail.com
Phone: (608) 266-2756

Frank J. Symons
Department of Educational Psychology
Education Science Building
56 River Road
University of Minnesota
Minneapolis, MN 55455
USA
e-mail: symon007@umn.edu
Phone: (612) 626-8697