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## Evaluation of Multiple Schedules With Naturally Occurring and Contrived Discriminative Stimuli Following Functional Communication Training

Kenneth D. Shamlan  
*University of Southern Maine*

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**EVALUATION OF MULTIPLE SCHEDULES WITH  
NATURALLY OCCURRING AND CONTRIVED DISCRIMINATIVE STIMULI  
FOLLOWING FUNCTIONAL COMMUNICATION TRAINING**

By

Kenneth D. Shamlan

B.S. Cairn University, 2000

M.Ed. University of Maine, 2005

M.S. University of Southern Maine, 2010

A DISSERTATION

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Psychology

(in School Psychology)

The University of Southern Maine December, 2012

Advisory Committee:

Advisor Mark W. Steege, Professor of School Psychology

Rachel Brown, Associate Professor of School Psychology

Wayne W. Fisher, H.B. Munroe Professor of Behavioral Research

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Kenneth D. Shamlan, M.Ed., M.S.

Dissertation Advisor: Dr. Mark Steege

An Abstract of the Dissertation Presented

In Partial Fulfillment of the Requirements for the Degree of Doctor of Psychology

(in School Psychology)

December, 2012

The purpose of this dissertation is to describe a doctoral research study designed to compare use of contrived and naturally occurring discriminative stimuli when using multiple schedules to thin reinforcement following functional communication training and their subsequent efficacy when introduced to novel contexts. Results indicated for one participant training with contrived stimuli was most effective, both contrived and naturally occurring stimuli were similarly effective for a second, and further modifications of a) pairing specific therapists to training conditions and, (b) adding toys during EXT components were necessary for either training condition to be effective for a third. For one participant, contrived discriminative stimuli were necessary <sup>to</sup> generalize the effects of FCT in novel contexts that are topographically similar.

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## LITERATURE REVIEW

Successful application of functional communication training (FCT) as an intervention for replacing problem behavior with an alternative communicative response to access the same functional reinforcer is well established in applied literature (Carr & Durand, 1985; Hagopian, Contrucci, Kuhn, Long, Rush, 2005; Tiger & Hanley, 2004; Tiger, Hanley, & Heal, 2006; Hanley, Iwata, Thompson, 2001; Fisher, Kuhn, & Thompson, 1998; Fisher, Thompson, Hagopian, Bowman, Krug, 2000; Hagopian, Fisher, Acquisto, & LeBlanc, 1998). The effectiveness of FCT is attributed to the premise of correctly identifying the function of the target problem behavior through experimental analysis (Carr & Durand, 1985). Initially, the individual is exposed to conditions of a functional analysis (e.g. Iwata, Dorsey, Slifer, Bauman & Richman, 1982/1994) to determine how the behavior operates on the environment (i.e. access to escape, attention, tangibles, sensory induction/reduction). Subsequently, the individual is initially taught an alternative, functional communicative response (FCR), based on the identified function, to replace the problem behavior (e.g. to gain access to attention, instead of hitting someone, the individual exchanges a card). This response is then typically trained with a dense schedule of reinforcement (e.g. fixed-ratio of 1:1 response-reinforcer relation; Kelley, Lerman, & Van Camp, 2002), evaluated to demonstrate its effectiveness in competing with problem behavior for the putative reinforcer (e.g. Fisher, 1998), and finally schedule thinning procedures are applied to make the intervention more practical in the natural environment (e.g. Hanley, Iwata, Thompson, 2001).

Schedule thinning as an extension following FCT has become recognized as an important component of treatment due to likely situations when a reinforcer would be

asked for with excessively high rates or could not be delivered easily (Volkert, Lerman, Call, & Trosclair-Lassette, 2009). A widely supported method for thinning reinforcement is training an individual to consistently emit the FCR when a correlated stimulus signals the availability of reinforcement and to extinguish responding when the absence or an alternative correlated stimulus is presented. This represents a trained response in a multiple-schedule arrangement where the duration of the extinction component can then be systematically increased to 'thin' periods when reinforcement is available (Hanley, Iwata, & Thompson, 2001). For example, Hanley, Iwata, & Thompson (2001) evaluated four separate methods for thinning the schedule of reinforcement for FCRs. Specifically, Hanley et al. exposed three participants to delay procedures of an FR1 schedule, graduated FI schedule, mixed schedule, and multiple schedule arrangements. Hanley et al., reported that for all three participants: (a) increasing delays resulted in extinction of the FCR, (b) the FI schedule produced undesirably high levels of the alternative behavior, and (c) the multiple schedules resulted in moderate and stable levels of the FCR. At the conclusion of treatment, the authors' reported participants' problem behavior maintained at low rates and the multiple schedule arrangement consisted of a reinforcement interval thinned to 60s and an extinction component extended to 240s.

The nature of using a multiple schedule arrangement for reinforcement thinning following FCT requires that there are salient discriminative stimuli present in the environment that signals when reinforcement is available or unavailable. Within the context of FCT, the majority of methods used in training and schedule thinning via a multiple schedule arrangement have used contrived discriminative stimuli (e.g. different colored floral leis, Tiger & Hanley, 2004; different colored cards, Hanley, Iwata,

Thompson, 2001; drawings/pictures, Fisher, Kuhn, & Thompson, 1998). For the purposes of this study, contrived discriminative stimuli are stimuli that are not normally present in the participant's natural environment but are introduced into the environment by the experimenter to signal the availability and unavailability of reinforcement contingent upon emitting the FCR. By contrast, naturally-occurring discriminative stimuli are stimuli that are currently present in the environment, and the experimenter correlates the components of a multiple schedule (i.e., alternating periods of reinforcement and extinction of the FCR) with these naturally-occurring stimuli. To date, only one published study has singularly examined the use of naturally occurring discriminative stimuli in a multiple schedule for thinning of reinforcement following FCT (Kuhn et al., 2010).

Given that using contrived stimuli presents some difficulties such as transportation of the stimuli, maintenance or replacement of the stimuli over time, and accurate presentation and removal of the stimuli to maintain correct responding (Tiger, Hanley, & Larsen, 2008), Kuhn et al. (2010) suggested using naturally occurring stimuli (i.e. overt caregiver behavior) would obviate some of these limitations and establish advancement in the use of multiple schedules for attention-maintained problem behavior. Kuhn et al. presented procedures for teaching individuals to attend to the overt behaviors of others in the natural environment as discriminative stimuli in the context of a multiple schedule as part of FCT as opposed to arbitrary or contrived stimuli (e.g. cards, pictures, leis). Following a functional analysis that demonstrated participants' problem behavior was maintained by social attention, they were taught an FCR similar to procedures used by Fisher et al. (1998). Once the participants (Angela and Greg) acquired the response,

Kuhn et al. conducted an evaluation to determine the treatment's effectiveness. The evaluation consisted of alternating conditions of functional communication training with extinction (FCT+EXT) and baseline sessions similar to the attention condition of the functional analysis in a reversal design. Results showed for both participants higher rates of problem behavior during baseline conditions and lower rates of problem behavior with concurrently higher rates of functional communication during FCT+EXT.

Next, discriminated functional communication training (DFCT) was conducted in a multiple baseline design across pairs of scenarios with both participants. The purpose of DFCT was to teach the participants' to attend to when adult attention was available based on overt behavior. During DFCT, participants were exposed to pairs of busy and non-busy therapist activities which alternated every 2.5 minutes during ten minute sessions in a multiple schedule arrangement. For example, a therapist would engage in a non-busy activity for the first 2.5 min., a busy activity for the following 2.5 min, reverse to a non-busy activity for 2.5 min., and finally engage in a busy activity again for the last 2.5 min. Activity order and type were randomized across sessions. Baseline sessions were identical to the FCT+EXT condition. DFCT conditions consisted of the therapist providing social attention for 30s contingent on the participant emitting the FCR during the non-busy activity and ignored all requests during busy activities. For Angela, results showed clear differentiation of FCRs during periods of non-busy activity almost immediately with Pair 1, and after twelve sessions for Pair 2. For Greg, results showed clear differentiation of FCRs during periods of non-busy activity almost immediately with both Pair 1 and Pair 2. In addition, a separate component was added for each participant to further decrease problem behavior observed during training. For Greg, an

observing response of “Are you busy?” was taught which successfully increased discriminated functional communication responding during non-busy activities vs. busy activities and further decreased problem behavior. For Angela, the addition of non-contingent access to preferred items successfully further lowered rates of problem behavior to acceptable levels.

After the initial FCT+EXT and DFCT evaluations, generalization probes were conducted to determine whether the skills of discriminated responding to overt therapist behavior would effectively transfer to untrained contexts. Six sessions were conducted, exposing each participant once to six separate pairs of busy and non-busy activities. Activity type and order was randomized in a similar manner to that described in the FCT+EXT condition. Results showed that both participants requested attention more frequently when the therapist engaged in non-busy activities (83%-92% of session).

The positive findings reported by Kuhn et al. are one example of success in thinning reinforcement using a multiple schedule with naturally occurring discriminative stimuli to signal when reinforcement is and is not available. However, it is worth noting that there were some limitations to the Kuhn et al. investigation. First, as mentioned by Kuhn et al., the number of contexts that a person encounters are too numerous to train individually. Thus, the amount of training and extent of the exemplars trained may not be initially realistic for therapists or caregivers to address. Secondly, there are also numerous caregiver behaviors that could be topographically similar but categorically different (e.g. a person engaging in activity that looks ‘non-busy’ but the person is ‘busy’) and provide a false signal for when reinforcement is available. For example, an adult playing a game on a laptop computer (i.e., non-busy) would be difficult to differentiate from the same

adult typing a resume (i.e., busy). Therefore, the ramifications for individuals' responding in the natural environment during schedule thinning following FCT are two-fold if the S<sup>D</sup>s are not easily discriminable: (a) probable effects of extinction in the form of decreased use of the FCR when communication would produce reinforcement, and (b) increased problem behavior.

Overall, determining the most effective procedures for training alternative communicative responses and their use in natural environments is imperative for increasing independent functioning of individuals with communication impairments who exhibit severe problem behavior. Research using multiple schedules with naturally occurring stimuli following FCT has demonstrated initial success in providing an end stage to reaching this goal. However, there is likely greater benefit using the technology of contrived stimuli when training individuals to use an FCR in a multiple schedule arrangement for reinforcement thinning, training the discrimination to new contexts, and transferring stimulus control from contrived stimuli to naturally occurring stimuli. The purpose of this current study was to evaluate training with contrived versus naturally occurring discriminative stimuli on: (a) the relative rate of acquisition and appropriate use of FCRs (differentially responding during the reinforcement interval vs. the extinction interval) in multiple schedule arrangements and (b) efficacy for generalizing discriminated responding to novel contexts.

Phase I of this study consisted of an evaluation of the FCR using multiple schedules with contrived and naturally occurring discriminative stimuli across participants. Phase II consisted of a post-training generalization evaluation to determine the efficacy of participant use of the FCR with both contrived and naturally occurring

discriminative stimuli when novel busy and non-busy activities were topographically similar (difficult discrimination pairs) vs. topographically dissimilar (simple discrimination pairs).

## **METHOD**

### **Participants and Setting**

Participants for this study were three individuals admitted on an outpatient basis for the assessment and treatment of severe problem behavior (Participant names have been replaced with pseudonyms to protect confidentiality). Bernard was a 5-year-old male, who had been diagnosed with autistic disorder. His primary topographies of problem behavior were disruption and disruptive vocalizations. He demonstrated he could follow multi-step instructions and communicate expressively with 3-5 word vocal responses. Maurice was a 5-year-old male also diagnosed with autistic disorder and referred primarily for disruptive behavior. Maurice could also follow multi-step instructions and communicate with 3-5 vocal responses. Donald was a four-year-old male receiving treatment for self-injurious behavior (SIB), aggression, and disruption. Previous diagnoses include autistic disorder and disruptive behavior disorder NOS. Donald did not have a functional vocal-verbal repertoire but demonstrated he could communicate by card touch.

All sessions were conducted in an individual therapy room (approximately 3 m x 3 m) with an observational one-way mirror. Session rooms contained a table, chairs, and other relevant session materials (e.g., therapist activity materials). All sessions were 10 minutes in duration and conducted approximately 2-6 times daily, 3- to 5-days per week.



### **Pre-Experimental Functional Analyses and FCT+EXT Evaluations**

As part of the inclusion criteria for this study, participants were required to: (a) engage in problem behavior reinforced by social-positive reinforcement as demonstrated by a functional analysis and (b) have responded to FCT + EXT (a minimum of an 85% reduction from baseline). Thus, each participant had a functional analysis completed using procedures similar to those described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) or a variation of a pairwise design (Iwata, Duncan, Zarcone, Lerman, & Shore 1994) to demonstrate a functional relation between problem behavior and socially mediated reinforcement. In addition, a functional communication training evaluation was conducted to demonstrate effective responding to FCT+EXT and acquisition of a FCR. Thus, all participants' functional analysis results demonstrated problem behavior was reinforced by either access to tangibles, for Bernard and Maurice, or, in the case of Donald, adult attention. In addition, participants' responding during FCT + EXT suggested that reinforcing appropriate, functional communication responses while placing problem behavior on extinction was successful for decreasing rates of problem behavior (See Figures 1 and 2).

Figure 1. Responses per minute for problem behavior during the functional analysis for Maurice (top), Bernard (middle), and Donald (bottom).

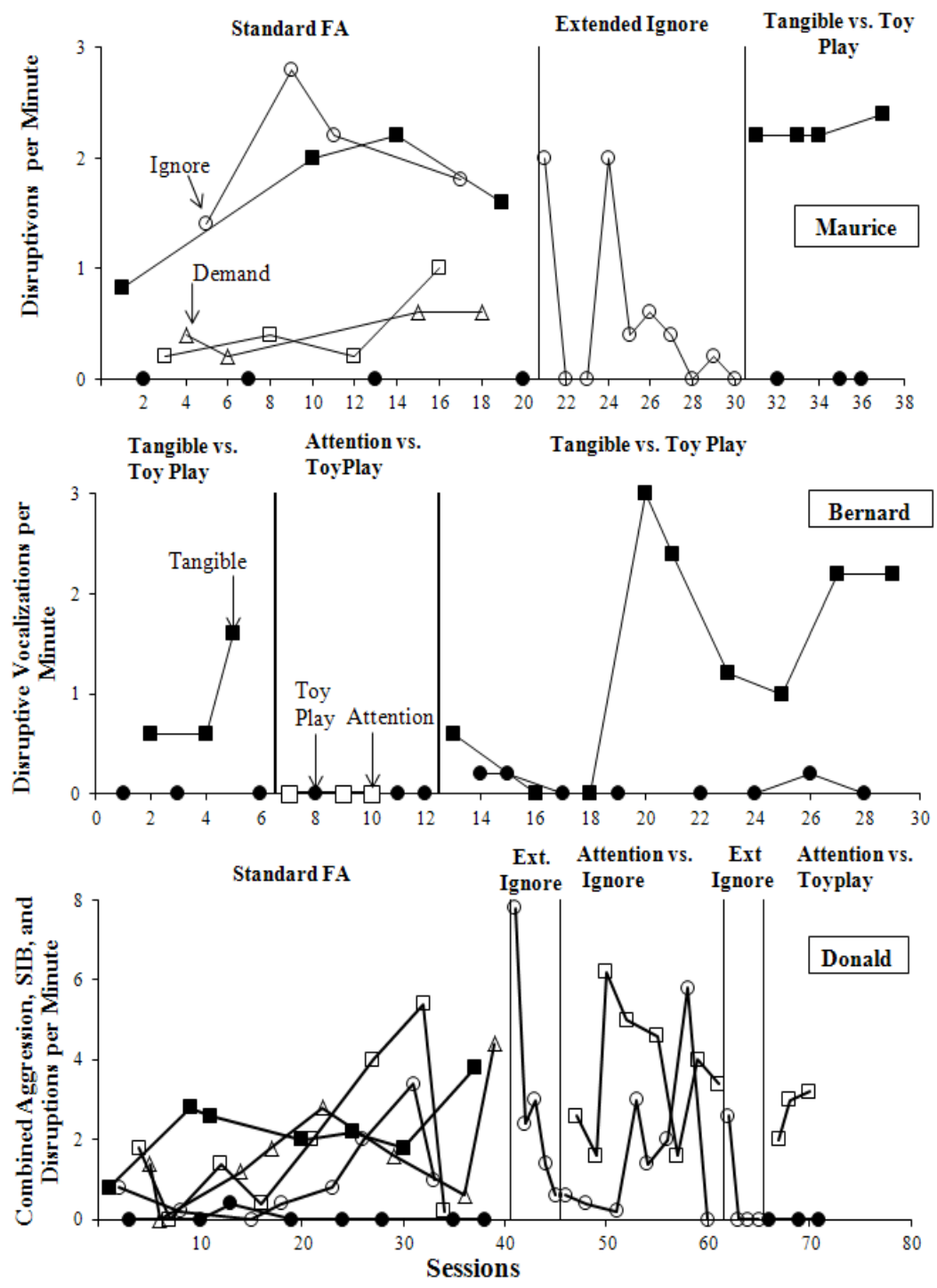
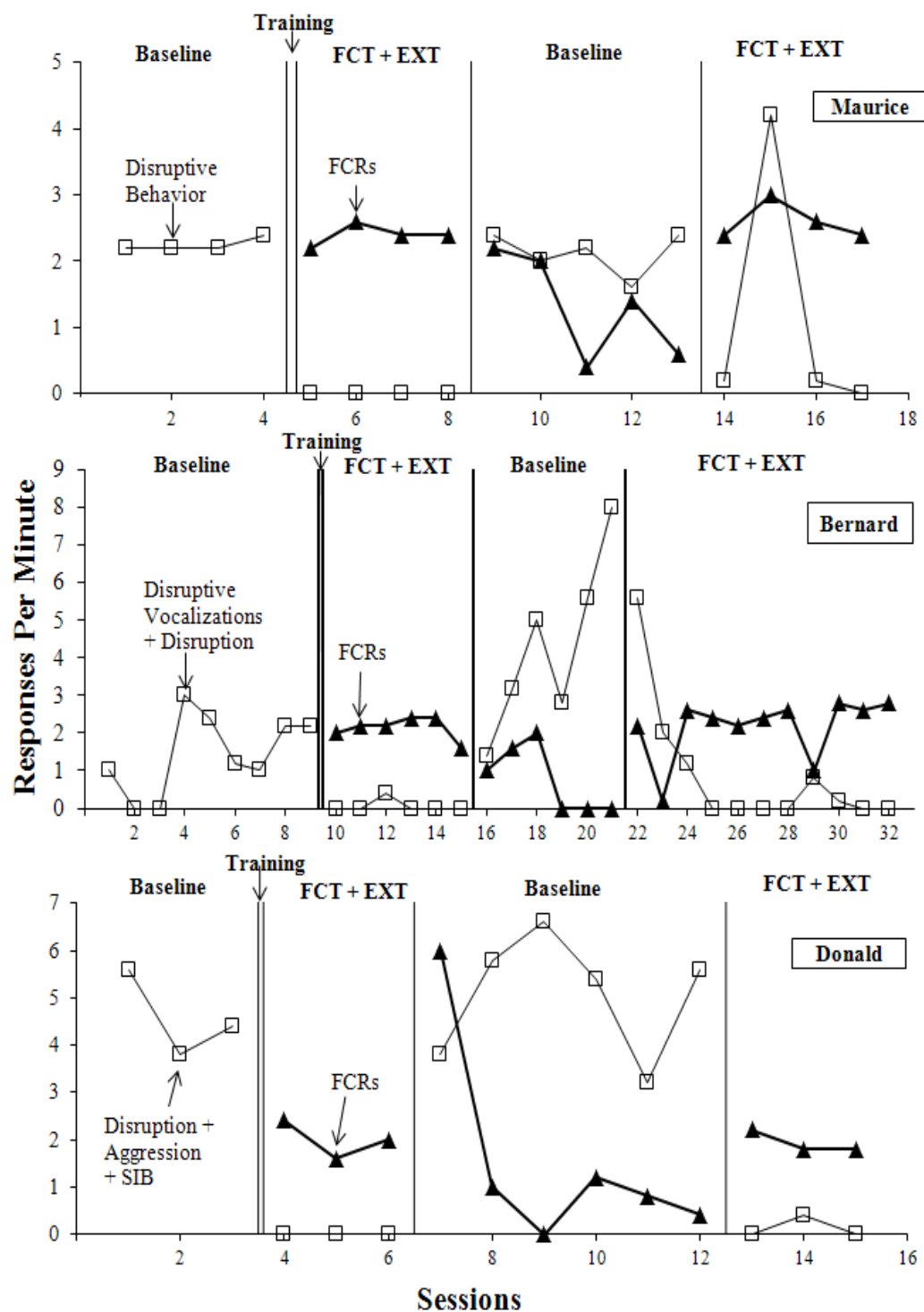


Figure 2. FCT Treatment Evaluation: Responses per minute of problem behavior and functional communication responses (FCRs) for Maurice (top), Bernard (middle), and Donald (bottom).



## **Response Measurement and Interobserver Agreement**

Trained observers used laptop computers to record data on the frequency of all participants' FCRs, primary problem behavior(s) during each condition (busy = extinction interval and non-busy = reinforcement interval), correct delivery of the S<sup>D</sup>, correct delivery of the functional reinforcer, and the duration that therapists actually engaged in busy and non-busy activities.

Bernard's functional communication response during this study was "Movie please.". His primary problem behavior was disruptive vocalizations (defined as negative vocalizations above a conversational level).

For Maurice, data were collected on the primary problem behavior of disruptions (defined as forceful pulling on the therapist's body or attempts to pull items from the therapist's hand). His functional communication response was saying "I want movie please."

The functional communication response for Donald was touching a card and primary problem behaviors were self-injurious behavior (defined as forceful contact of the head against a hard surface), aggression (defined as hitting or attempts of forceful contact with an open or closed hand against a therapist), and disruption (defined as throwing items 12 inches or more but not directed at a therapist).

During all analyses and treatment evaluations, a second observer simultaneously, but independently, collected data. Interobserver agreement (IOA) was determined by dividing each session into consecutive 10-s intervals and comparing the data of both observers. Agreement was defined as both observers scoring the same frequency of participants' target responses within a 10-s interval. An agreement coefficient was

calculated for each session by dividing the number of agreements by the number of agreements plus disagreements and converting the resulting quotient to a percentage.

For Bernard, IOA data were collected during 37% of all sessions; mean agreement was 94.2% (range, 88% to 100%) for disruptive vocalizations, 99% for functional communication responses (range, 96% to 100%), and 98.1% for correct delivery of the  $S^D$  (range, 98% to 100%) and the functional reinforcer.

For Maurice, IOA data were collected during 34% of all sessions; mean agreement was 89.4% (range, 76% to 100%) for disruptive, 98.4% for functional communication responses (range, 96% to 100%), and 98.2% for correct delivery of the  $S^D$  (range, 98% to 100%) and the functional reinforcer (range 99% to 100%).

For Donald, data were collected during 43% of all sessions; mean agreement was 99% (range, 97% to 100%) for disruptions, 99% (range, 97% to 100%) for self-injurious behavior, 100% for aggression, 98% for functional communication responses (range, 97% to 100%), and 93% for correct delivery of the  $S^D$  (range, 75% to 100%), and the functional reinforcer.

Interobserver agreement for duration-based measures was determined by dividing each session into consecutive 10-s intervals and comparing the data of both observers. Within each 10-s interval, the lower duration recorded (e.g., Observer A recorded 6 s) was divided by the higher duration recorded (e.g., Observer B recorded 7 s) to create a quotient. For intervals in which both observers recorded 0-s, a value of 1 was recorded for that interval (because one cannot divide by zero). These quotients were averaged within and across sessions to obtain an overall measure of agreement for duration

measures. Mean interobserver agreement was 97% for Donald, 99% for Bernard, and 99% for Maurice.

### **Experimental Design**

All three participants were exposed to two conditions. One condition consisted of FCT using a multiple schedule (MULT 150/150 FR1) with naturally occurring discriminative stimuli ( $S^D$ s) correlated with either “busy” or “non-busy” activities (See Table 1). The second condition consisted of FCT using a multiple schedule (MULT 60/60 FR1) with contrived  $S^D$ s. The purposes of the evaluations were to establish (a) use of the FCR when reinforcement is available while maintaining low rates of problem behavior (Phase I) , and (b) a history of discriminated responding for evaluation in post-training generalization sessions (Phase II).

Table 1

*Simple and Difficult Pairs of Busy and Non-busy Activities*

Simple Discrimination Pairs		Difficult Discrimination Pairs	
Therapist busy activities	Therapist non-busy activities	Therapist busy activities	Therapist non-busy activities
Cooking	Sitting doing nothing	Filing electronic federal and state taxes on a laptop	Searching for entertainment news on a laptop
Writing	Reading a newspaper	Finishing a math assignment for a class	Completing a Sudoku puzzle game sheet
Napping	Reading a magazine	Writing a resignation letter to your administrator	Writing a thank-you note
Cleaning	Listening to music	Studying for an exam	Reading a short non-fiction story in a book
Talking	Watching television		
Telephone	Brushing hair		

During Phase I, a combined alternating treatments (Barlow & Hayes, 1979) and non-concurrent multiple baseline design (MBD) across participants (Watson & Workman, 1981) was used to evaluate treatment conditions. Primary rationale for the use of the non-concurrent MBD was attributed to the clinical consideration of retaining the flexibility to assign participants to various baseline lengths as they were naturally referred. Given that clients referred to the clinic present with a wide range of target problem behaviors with potentially differing functional relations, a concurrent MBD would have likely been impractical. In addition, the non-concurrent MBD assisted in avoiding the theoretical disadvantage involving the assumption of reversibility of treatment effects and strengthened the conclusions that the changes in behavior observed in treatment were a function of the independent variables introduced relative to varied baseline lengths (Watson & Workman, 1981). Overall, in addition to the advantages noted above, the use of this design specifically controls for maturation effects but also presents the limitations in that it represents a series of A-B designs with staggered baselines that do not present an intra-subject, functional replication. However, the addition of the alternating treatments design helps further rule out internal validity concerns of maturation, and inter-subject variability. One potential weakness of the addition of this design is that of multiple treatment interference in relation to sequential confounding or carryover effects. Yet, in the case of this study, the two treatments were: (a) conducted in a randomized order per clinic appointment which would likely rule-out sequential effects and, (b) consisted of distinct stimulus conditions (i.e. overt therapist activities vs. bracelet on/off) which theoretically would contribute to ruling out carry-over effects.



In conclusion, given that the study was primarily aimed at interests related to the efficiency and effectiveness of skill acquisition for an alternative communication response and the practical (and potentially ethical) constraints of the population and target problem characteristics, the design presents a sound experimental approach

Phase II, consisted of a BCBC design to compare the generality of training effects with the naturalistic and contrived  $S^D$ s for the simple and difficult pairs of busy and non-busy activities listed in Table 1. In addition, a multielement design was used within each phase of the BCBC design to compare the generality of training effects to the simple pairs versus difficult pairs of novel busy and non-busy activities.

### **Phase I: Functional Communication Training Using a Multiple Schedule with Naturally Occurring and Contrived Discriminative Stimuli**

#### **FCT Using a Multiple Schedule with Naturally Occurring Discriminative Stimuli**

Participants were exposed to sessions of two DFCT conditions in an alternating fashion consisting of: (a) contrived  $S^D$ s and (b) naturally occurring  $S^D$ s. The condition with naturally occurring  $S^D$ s was similar to Kuhn et al. (2010) in which participants were taught use of the FCR during times when overt therapist behavior (busy vs. non-busy) signaled the availability of reinforcement in the form of attention or a tangible. The second condition consisted of training contrived  $S^D$ s in a multiple-schedule arrangement.

Pairs of busy and non-busy activities during participants' baseline and training sessions were assigned randomly from the table of activities. Bernard's training pairs were cleaning (busy) vs. brushing hair (non-busy) and writing (busy) vs. reading a magazine (non-busy), for Pair 1 and Pair 2 respectively. For Maurice, Pair 1 and Pair 2 activities consisted of talking on the phone (busy) vs. listening to music (non-busy) and

cooking (busy) vs. reading a newspaper (non-busy). Donald's busy and non-busy activities for Pair 1 and Pair 2 were talking to another therapist (busy) vs. watching TV/movie (non-busy) and napping (busy) vs. sitting doing nothing (non-busy).

**Baseline.** Sessions consisted of exposing each participant to two pairs of busy and non-busy activities randomly selected and ordered from a master list (See Table 1). Baseline sessions were 10 minutes, and the therapist began each session upon entering the room with the participant. The therapist engaged in the first selected pair of activities, alternating between 2.5 minutes of a busy activity and 2.5 minutes of a non-busy activity. In addition, the order of which activity type the participants were exposed to within a session was randomized across sessions such that approximately half of the sessions started with a busy activity and approximately half started with a non-busy activity. Contingencies for the baseline sessions consisted of providing attention or the identified tangible for 30s for the appropriate FCR across both busy and non-busy activities with no programmed consequences for problem behavior (EXT).

**Training.** During training with naturally occurring  $S^D$ s, activity type and order of pairs were randomized in a similar fashion to baseline except that (a) training began with a single busy-non-busy pair, and was trained to a mastery criterion before the second busy/non-busy pair was introduced into the treatment sessions; and (b) each treatment session started with a non-busy activity (i.e. reinforcement will be available) followed by a busy activity, and the order of subsequent components randomized. Sessions began with the therapist entering the session room with the client, and engaging in the assigned pair of busy and non-busy activities. If the participant emitted the FCR during a non-busy activity, the therapist provided either social attention or access to a tangible for 30

seconds. If the participant emitted the FCR during intervals in which the therapist was engaging in a busy behavior, the therapist ignored the participants' request(s). Similar to baseline procedures, there were no programmed consequences for problem behavior during both activity types during sessions (i.e. EXT).

### **FCT Using a Multiple Schedule with Contrived Discriminative Stimuli**

**Baseline.** Baseline sessions were conducted in a multiple schedule FR1/FR1 arrangement. The first component was signaled with the presence of a contrived  $S^D$  (a colored, rubber bracelet) and the second component was signaled by the absence of the  $S^D$ . The  $S^D$  for signaling the reinforcement interval was selected based on parental reports of what type of stimulus would likely be effective and acceptable in the natural environment. Each session began with a 60-s reinforcement component with the contrived  $S^D$  present, immediately followed by a second 60-s extinction component with contrived  $S^D$  absent. Following these first two components of the multiple schedules, the order of subsequent components was presented in a quasi-randomized fashion with the criterion that neither component occurred consecutively for more than two intervals. When the participant emitted the FCR during baseline, the therapist provided either 30-s access to social attention or a tangible on an FR1 schedule regardless of whether the  $S^D$  was present or absent. For Bernard and Maurice, the functional reinforcer was access to a preferred video. For Donald, the functional reinforcer was access to adult attention in the form of tickles or other forms of playful attention. There were no programmed consequences for problem behavior during both components of the schedule.

Measurement procedures were similar to those previously described in the training procedures with naturally occurring  $S^D$ s.

**Training.** During training, sessions consisted of a multiple 60/60 condition similar to baseline except that: (a) the therapist delivered a rule to the participant at the beginning of the session that specified the contingencies in effect for the FCT, (b) the therapist presented and removed the  $S^D$  in the participant's line of vision to make the stimulus changes salient, and (c) the multiple schedule consisted of an FR1 schedule of the functional reinforcer for emitting the FCR, and an EXT component correlated with presence and absence of the contrived  $S^D$ , respectively.

The session began when the therapist entered the room with the participant. The therapist presented the contrived, discriminative stimulus that signaled when reinforcement was available. The therapist showed the contrived  $S^D$  to the participant and provided the rule, "When the bracelet is on, you can ask me for attention (or video) and I will give it to you. When the bracelet is off, you can ask me for attention (or video), but I will not answer/give it to you." Each session began with a 60-s reinforcement component immediately followed by a 60-s EXT component. Following the first two intervals, the subsequent components were presented in a quasi-randomized order with the criterion that neither component occurred consecutively for more than two intervals. Sessions were 10 minutes in duration. Similar to baseline procedures, there were no programmed consequences for problem behavior during both components of the schedule.

During the reinforcement component in which the contrived  $S^D$  was present, the therapist did not provide social attention (in the case of Donald) or access to the video (in the case of Bernard and Maurice) until the participant emitted the appropriate FCR. When the participant engaged in the appropriate FCR, the therapist provided 20-s access to social attention or the video on an FR1 schedule. During the EXT component, when the

$S^D$  was not present, the therapist did not provide social attention and there were no programmed consequences for appropriate use of the FCR.

### **Additional Discrimination Training & Pairwise Evaluation of Preferred Items**

#### **During Training (Donald Only)**

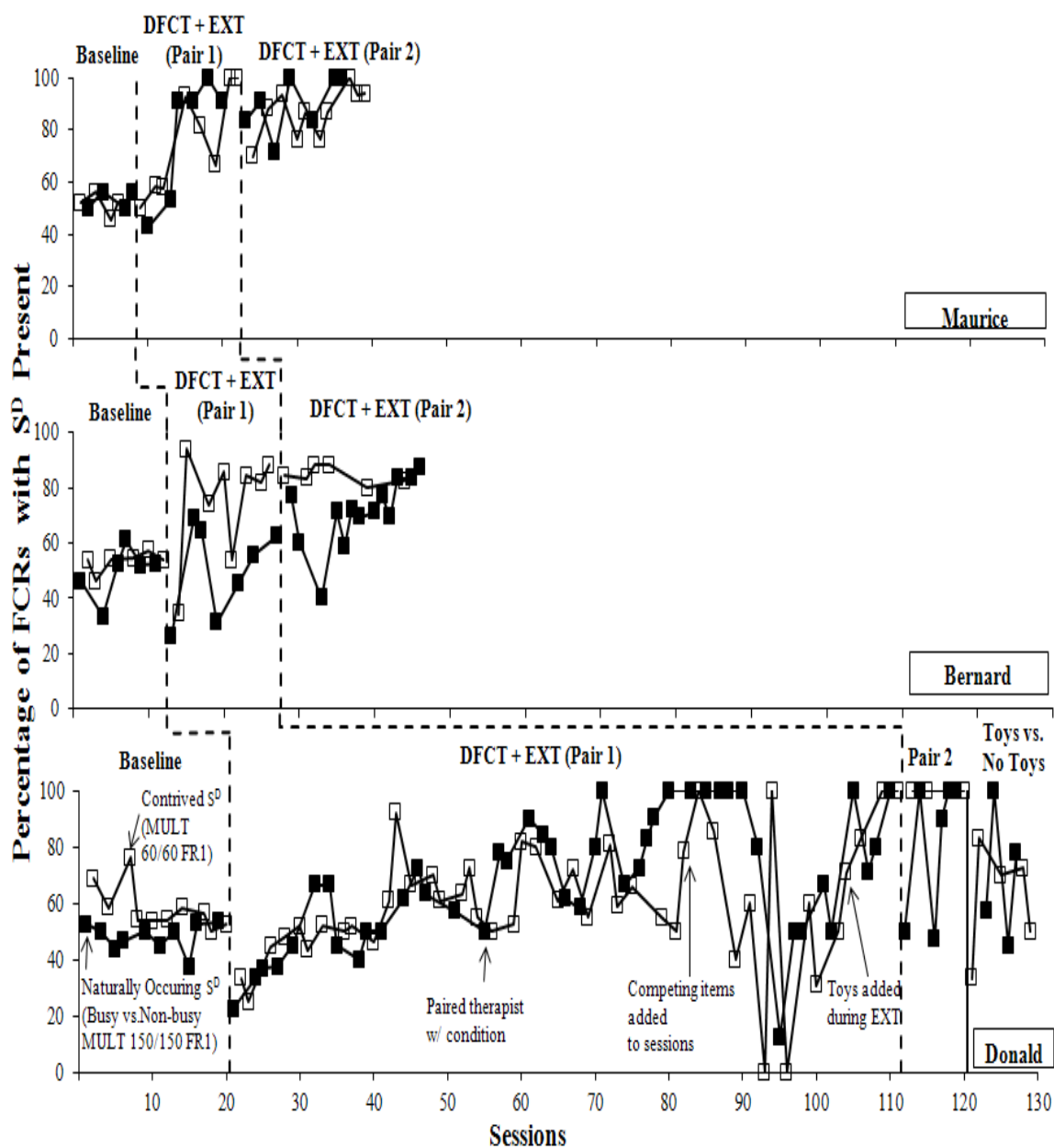
During the procedure for discrimination training, Donald's allocation of FCRs in both the naturally occurring and contrived  $S^D$  conditions was variable and not improving above baseline levels at an acceptable rate. Within session, it was observed that Donald was continuing to mand for attention and physically attempt to engage the therapist consistently during the EXT components across both training conditions. Therefore, after 54 treatment sessions of Pair 1 activities, training procedures were modified to include a specific therapist paired with each condition. In addition, after session 81, competing items (preferred toys) were made available during all sessions, and after session 104, the toys were made available only during the EXT components in both training conditions. During sessions with the final modification, a therapist would provide the toys to Donald when the EXT components began and remove them when the contingencies for a reinforcement component were in effect. All other procedural details for these modified training sessions were identical to those previously described for Phase I. It was hypothesized that the addition of pairing a specific therapist with the condition would aid in stimulus control for signaling the training condition in effect for a session. It was further hypothesized that the addition of toys to the entire session, and finally only to the extinction components of both conditions, would attenuate Donald's continuing to mand for attention and engage with the therapist during the extinction components while concurrently reducing problem behavior (Hagopian, 2005). However, during the

remaining sessions after the final modification to the training procedures, it was observed that Donald's responding, while meeting the mastery criterion, may possibly have come under the stimulus control of the presentation and removal of the toys during sessions and not the salient  $S^D$ s for the training conditions. Therefore, a series of sessions were completed in separate phase in which all procedures were similar to those described above, for both contrived and naturally occurring  $S^D$  training conditions, with the exception that toys were present or toys or absent throughout the entire session. It was hypothesized that if the salient  $S^D$ s had acquired discriminative control over Donald's allocation of FCRs for when reinforcement was available, treatment gains would remain stable across conditions. Conversely, if the presence or absence of the toys during either both or one of the training conditions showed significant reduction in treatment gains as observed in previous sessions, it could be concluded that the relevant  $S^D$ s did not exert discriminative control. The evaluation of the trained  $S^D$ s over Donald's responding was necessary to determine if the generalized effects of the trained  $S^D$ s to novel contexts in Phase II could be tested.

## RESULTS AND DISCUSSION

Figure 3 shows the percentage of functional communication responses of participants that occurred in the presence of either (a) the contrived  $S^D$  or, (b) the naturally occurring  $S^D$  (i.e., therapist non-busy activity) across baseline and treatment conditions for both naturally occurring  $S^D$  training pairs and the contrived  $S^D$  condition.

Figure 3. Percentage of Functional Communication Responses across Participants for Pairs 1 and 2 of DFCT with Naturally Occurring and Contrived Discriminative Stimuli for Maurice (top), Bernard (middle), and Donald (bottom).



Percentages were calculated by dividing the number of FCRs that occurred in the presence of the salient  $S^D$  (i.e. bracelet on or off for the contrived  $S^D$ , or therapist(s) engaging in busy vs. non-busy activities) by the total number of FCRs that occurred across the multiple schedule components of both conditions within sessions, and converting the quotient to a percentage. Baseline levels of communication during baseline exposure to Pairs 1 and 2 with naturally occurring and contrived  $S^D$  sessions were similar for Maurice (top panel) (Pair 1:  $M = 50\%$ ; Pair 2:  $M = 56.2\%$ ; Contrived  $S^D$   $M: 51.5\%$ ), Bernard (middle) (Pair 1:  $M = 43.6\%$ ; Pair 2:  $M = 55.3\%$ ; Contrived  $S^D$   $M: 53\%$ ), and Donald (bottom panel) (Pair 1:  $M = 45.8\%$ ; Pair 2:  $M = 50.4\%$ ; Contrived  $S^D$   $M: 53.1\%$ ). Following training sessions in which the therapist only provided access to the functional reinforcer in the presence of the contrived and naturally occurring  $S^D$ s, more rapid discrimination and greater percentage of FCRs for tangibles were observed in the contrived  $S^D$  condition for Bernard during training with Pair 1 (Contrived  $S^D$ :  $M = 78.5\%$ ; Naturally Occurring  $S^D$  Pair 1:  $M = 69.5\%$ ) and Pair 2 (Contrived  $S^D$ :  $M = 84.4\%$ ; Naturally Occurring  $S^D$  Pair 2:  $M = 70.8\%$ ). Furthermore, Bernard met the mastery training criterion of three consecutive sessions for any condition with allocation of 80% or greater of FCRs with  $S^D$ s present in the contrived  $S^D$  condition more rapidly (Contrived  $S^D$  sessions:  $N = 7$ ; Naturally Occurring  $S^D$  Pair 1 sessions: Mastery criterion unmet) and maintained levels for the remainder of training sessions and introduction of Pair 2. During training with Pair 2, Bernard maintained mastery criteria for the contrived  $S^D$  condition within the first three sessions and therefore a ratio of 1:4 was implemented for training contrived vs. naturally occurring  $S^D$  sessions to reach mastery levels of



responding . Bernard required approximately four times the exposure to the naturally occurring  $S^D$ s of Pair 2 ( $N=14$ ) to meet mastery training criteria in Phase I.

For Maurice (top panel), approximately similar rates of discrimination and allocation of FCRs for tangibles was observed in both the contrived and naturally occurring  $S^D$  training condition for Pair 1 ( Contrived  $S^D$  :  $M = 75.9\%$ ; Naturally Occurring  $S^D$  Pair 1:  $M = 77.8\%$  ) and Pair 2 (Contrived  $S^D$  :  $M = 82.5\%$ ; Naturally Occurring  $S^D$  Pair 2:  $M = 89.8\%$  ). The mastery training criterion for Maurice was two consecutive sessions at 100% or three non-consecutive sessions at 90% or greater allocation of FCRs with  $S^D$ s present. Maurice met the mastery criterion in the naturally occurring  $S^D$  training condition sessions more quickly (Naturally Occurring  $S^D$  Pair 1:  $N = 5$  ; Contrived  $S^D$  :  $N = 8$ ). During training with Pair 2, Bernard also met the mastery criterion in the naturally occurring  $S^D$  training condition sessions more quickly (Naturally Occurring  $S^D$  Pair 2:  $N = 7$  ; Contrived  $S^D$  :  $N = 10$ ) and did not initially maintain the mastery criterion for the contrived  $S^D$  condition sessions although training conditions were exactly similar to previous sessions in which he demonstrated mastery.

For Donald (bottom panel), approximately similar rates of discrimination and allocation of FCRs for attention were observed in both the contrived and naturally occurring  $S^D$  training condition for Pair 1 for sessions 1-54 in which he was exposed to the standard training protocols for each condition (Contrived  $S^D$  :  $M = 49.9\%$ ; Naturally Occurring  $S^D$  Pair 1:  $M = 45.9\%$  ). Due to the failure to respond to discriminative use of the FCR when the  $S^D$  was present above mean levels observed in baseline (Contrived  $S^D$  Baseline:  $M = 53.5\%$ ; Naturally Occurring  $S^D$  Baseline Pair 1:  $M = 45.8\%$ ; Pair 2:  $M = 50.4\%$ ), competing, preferred items were added to the room during sessions 55-104.

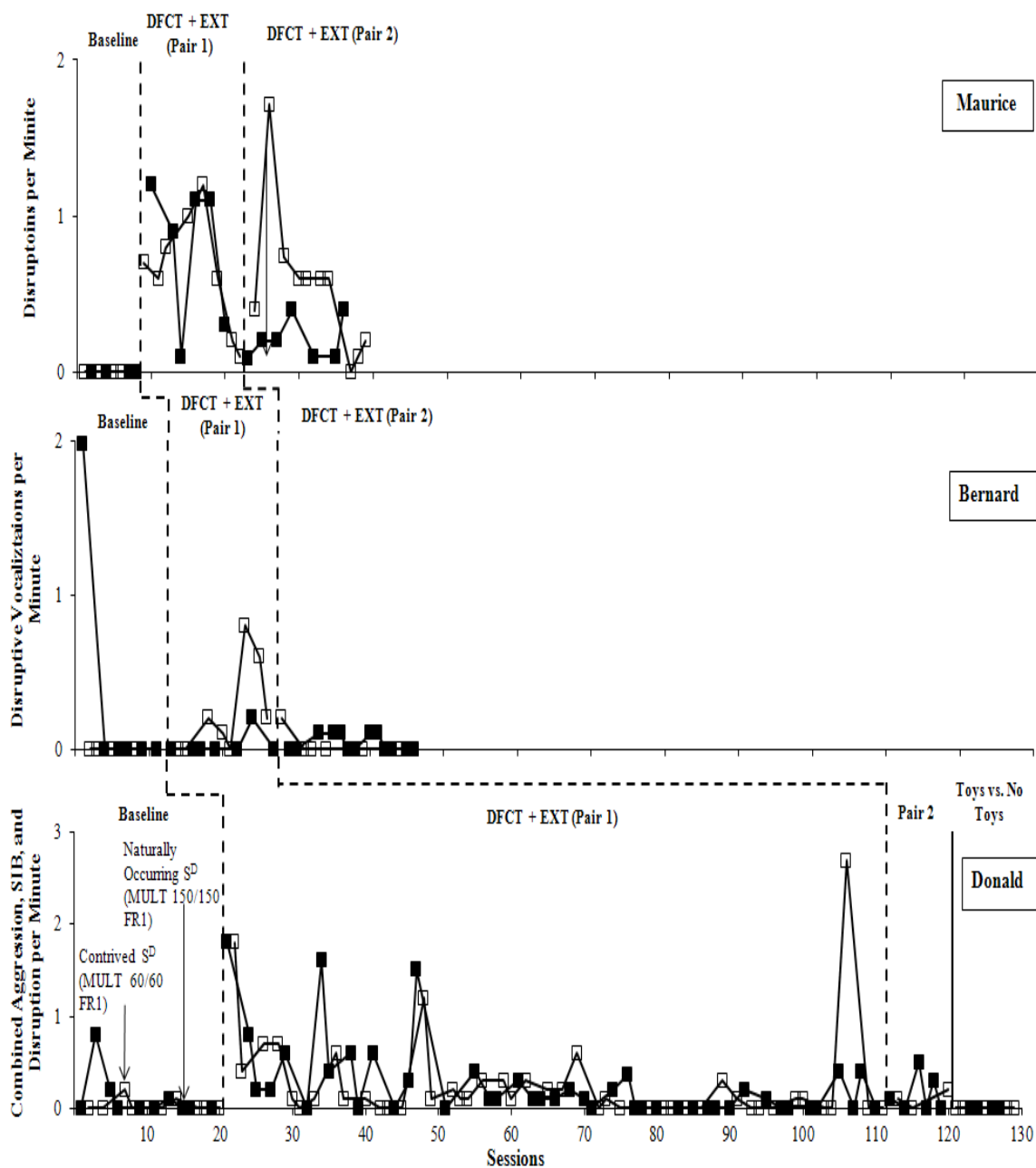
Slightly greater mean levels of allocation of FCRs for attention were observed in the naturally occurring S<sup>D</sup> training condition ( $M = 76.1\%$ ). Although mean levels were low during this change in the training protocol for Donald, he did meet the mastery criterion at session number 100 (three non-consecutive sessions at 80% or greater or two consecutive sessions at 100% of FCRs allocated to when S<sup>D</sup>s were present). However, given the previous variability and additional procedures added, training sessions were continued to observe stability in responding. Subsequent responding again demonstrated wide variance (range, 0% to 100 %) in later sessions. Due to the continued variability and failure to respond to training at mastery levels, toys were added to the EXT component during sessions 105 to 120. During this third modification to the training protocol, Donald met the mastery criterion for Pair 1 of naturally occurring and contrived S<sup>D</sup> training conditions within four sessions. During training with Pair 2, with continued presentation of toys during the EXT components, Donald met the mastery criterion in similar amounts of sessions for both the naturally occurring and contrived S<sup>D</sup> conditions (Naturally Occurring S<sup>D</sup> Pair 2:  $N = 5$  ; Contrived S<sup>D</sup> :  $N = 3$ ) with significantly greater averages from baseline (Contrived S<sup>D</sup> :  $M = 100\%$ ; Naturally Occurring S<sup>D</sup> Pair 2:  $M = 77.4\%$ ).

Following training of Pair 2, Donald was exposed to two sessions of each training condition with and without toys present during an alternating evaluation to determine potential confounding effects for discrimination of schedule contingencies (Contrived S<sup>D</sup> toys present :  $M = 68\%$ ; Contrived S<sup>D</sup> toys absent:  $M = 62.5\%$ ; Naturally Occurring S<sup>D</sup> toys present:  $M = 67.5\%$ ; Naturally Occurring S<sup>D</sup> toys absent:  $M = 72.5\%$ ). The analysis provided a repeated demonstration of failure to maintain mastery criteria without the

presentation and removal of toys correlated with changes in the schedule components during both conditions.

Figure 4 depicts rates of problem behavior demonstrated by participants during baseline and DFCT training sessions across contrived and activity pairs of naturally occurring S<sup>D</sup> conditions.

Figure 4. . Responses of Problem Behavior per Minute for Participants for Pairs 1 and 2 of DFCT with Naturally Occurring Discriminative Stimuli and Contrived Discriminative Stimuli for Maurice (top), Bernard (middle), and Donald (bottom).



For Maurice (top panel), mean baseline rates for disruption remained at zero rates during all conditions. Once training procedures were implemented for Pair 1 with naturally occurring S<sup>D</sup>s and contrived S<sup>D</sup>s there was an initial increase in the rates of problem behavior per minute (Contrived S<sup>D</sup>:  $M = .65$ ; Naturally Occurring S<sup>D</sup> Pair 1:  $M = .78$ ) but with little differentiation between conditions. This initial increase in disruptions per minute was also observed when implementing training for Pair 2 although slightly more elevated during the contrived S<sup>D</sup> condition (Contrived S<sup>D</sup>:  $M = .55$ ; Naturally Occurring S<sup>D</sup> Pair 1:  $M = .2$ ). Mean baseline rates of problem behavior for Bernard (middle panel) during exposure to Pairs 1 and 2 with naturally occurring S<sup>D</sup> were .66 and 0 per minute, respectively, and 0 per minute during contrived S<sup>D</sup> sessions. During DFCT procedures, mean rates of problem behavior during training of Pairs 1 and 2 with naturally occurring S<sup>D</sup>s were .03 and .04 per minute, respectively, and .14 per minute during contrived S<sup>D</sup> sessions. Similar to the other two participants, Donald (bottom panel) demonstrated near zero rates of problem behavior during baseline for Pairs 1 and 2 and the contrived S<sup>D</sup> condition ( $M_s = .2$  and  $.02$  for Pair 1 and Pair 2 respectively, and  $M = .03$  for Contrived S<sup>D</sup>s). During initial training sessions across conditions there was a slight increase in the rates of problem behaviors during training (Contrived S<sup>D</sup>:  $M = .21$ ; Naturally Occurring S<sup>D</sup> Pair 1:  $M = .21$ ) and this pattern was observed again but with decreased levels when compared to baseline rates when implementing training for Pair 2 (Contrived S<sup>D</sup>:  $M = .06$ ; Naturally Occurring S<sup>D</sup> Pair 2:  $M = .12$ ).

For Phase I, the predicted results for training under the two conditions were that:

(a) participants' FCRs in the contrived S<sup>D</sup> condition were likely to show more rapid acquisition of discriminated responding and decreases in problem behavior and, (b) in the

naturally occurring  $S^D$ 's condition, participants FCRs were likely to show slower rates of acquisition and decreases in problem behavior. In relation to acquiring discrimination for appropriate use of the FCR, Bernard was the only participant whose results confirmed both these hypotheses as demonstrated by requiring fewer sessions in the contrived vs. the naturally occurring  $S^D$  training conditions. Maurice showed relatively comparable, if not slightly more rapid acquisition, discriminated responding during the natural  $S^D$  condition. In addition, Maurice's data suggest that during training for Pair 2, he did not maintain levels of the mastery criterion for discriminated responding during the contrived  $S^D$  condition although sessions were identical. These findings are somewhat paradoxical in that there does not appear to be a clear method for determining variables that would have contributed to Maurice's inability to maintain previous levels of successfully allocating mands during reinforcement components of the schedule. Results for Donald are perhaps the most variable among the participants. Donald required one-hundred and twenty sessions and two modifications of the proposed training protocol to which the other participants were successfully exposed. A hypothesis for Donald's continued communicative attempts during EXT components of both conditions are two-fold. First, Donald's level of developmental delays and younger age compared to other participants may indicate that the protocol as outlined for training may have characteristics that are not sufficient to acquire discriminative control for some children. As some findings have indicated, there is a positive correlation between IQ and tolerance for delayed reinforcement (Mischel & Metzner, 1962). Whether this was a factor in Donald's case is unknown, however, the subsequent analysis of the discriminative function of the toys during training demonstrated that without concurrent alternative sources of reinforcement

that also functioned as conditioned discriminative stimuli for the reinforcement contingencies, Donald did not allocate his FCRs selectively to the reinforcement components. Secondly, there is potential that the strength of the reinforcement history for continuing to mand when attention was not available influenced resistance to extinction operations. Thirdly, the presence of an adult who was not providing attention could have still functioned as a conditioned  $S^D$  due to an extended history that included intermittent reinforcement with unknown reinforcement parameters. For example, for Donald the functional reinforcer was attention as compared to tangibles of movie access. While clear restriction of the tangible reinforcers were evident in sessions with Bernard and Maurice, the presence of and actions towards the therapist (in the absence of a salient, concurrent alternative form of reinforcement) by Donald may still have provided some sufficient and qualitative attention that maintained manding during extinction. It is also unclear whether training with the multiple schedule values used in this study were sufficient for Donald. For example, Tiger and Hanley (2004) found that contrary to Hanley et al. (2001), one participant did not demonstrate discriminated manding under multiple schedule conditions. These differences were attributed most likely due to the procedural differences of schedule fading (MULT FR1 45/15 to MULT FR1 60/240) rather than training participants at a terminal schedule requirement (MULT FR1 60/60 ). Thus, perhaps Donald would have responded to the training conditions if schedule fading had been implemented in a step-wise fashion. Future research aims might determine the : (a) efficacy of initial schedule requirements, (b) potential effects of functional reinforcer type/topography, and (c) levels of adaptive functioning or developmental delays that affect operative discrimination during multiple schedule training. Such findings could

provide beneficial suggestions for modifications based on individual variability of responding.

In relation to problem behavior observed in Phase I and the predicted results of more rapid decreases in problem behavior during the contrived  $S^D$  conditions, all three participants demonstrated near equal rates and/or trends across both conditions. Bernard and Donald showed little change in rates from training across both conditions and when the Pair 2 training activities were initiated in the naturally occurring  $S^D$ s condition. Maurice's pattern of disruptive responding showed what may be a more characteristic pattern of exposure to extinction operations which was repeated again when Pair 2 was introduced (i.e., extinction burst). However, differences in rates were not significant and rates during sessions in which mastery criteria were met remained low. Overall, these results suggest that participants' problem behavior was sensitive to the contingencies associated with extinction.

### **Phase II: Post-Training Generalization**

Bernard was the only participant to complete the post-training generalization probes. Maurice was not able to complete Phase II due to withdrawal from the research project by his parents. Donald was not able to complete Phase II due to failure to adequately meet the criteria for Phase I. Therefore, once Bernard demonstrated discriminated responding as measured by the criterion of three sessions with at least 80% of FCRs allocated to the reinforcement components during both pairs of activities with the naturally occurring  $S^D$ s and the contrived  $S^D$  conditions, he was exposed to generalization probes. The purpose of this phase was to evaluate the conditions under which training naturally occurring and contrived  $S^D$ s in the context of a multiple schedule



would occasion appropriate use of the trained FCR while maintaining low levels of problem behavior when presented with novel contexts.

### **Busy and Non-busy Generalization Activities**

Table 1 lists the busy and non-busy activities that were used for Bernard to test for generalization during Phase II. The left side of Table 1 shows busy and non-busy tasks that are similar or identical to ones used in the Kuhn et al. (2010) investigation. These busy and non-busy tasks are labeled “Simple” because they were hypothesized as activities that participants should readily discriminate (or show generalization for) following the training in Phase I. The right side of Table 1 shows busy and non-busy tasks that share many more physical features between each pair than the ones used in the Kuhn et al. study. These busy and non-busy tasks are labeled “Difficult” because they were hypothesized as activities that participants should **not** readily discriminate (**nor** show generalization for) following the training in Phase I. By contrast, it was hypothesized that the contrived  $S^D$  would promote generalization for both the simple and difficult busy/non-busy pairs because stimulus control of the FCR is tied to the presence or absence of the contrived  $S^D$  rather than based on individual discriminations for each busy/non-busy pair as to whether or not the individual was actually busy.

### **Experimental Design and Procedures**

In the first phase of the BCBC design, the simple pairs were presented in one condition and the difficult pairs were presented in the second condition, and these two conditions (simple vs. difficult) were alternated in accordance with a multielement design. The contrived  $S^D$  was not present in Phase 1, so it was hypothesized that the participants would discriminate between the busy and non-busy activities on the basis of

similarities between the naturally occurring stimuli present during the generalization tasks and the naturally occurring stimuli that were present during the training in Phase I. In the second phase of the BCBC design, the simple pairs were presented in one condition and the difficult pairs were presented in the second condition, and these two conditions (simple vs. difficult) were alternated in accordance with a multielement design. However, in both the simple and difficult conditions, the contrived  $S^D$  was present and signaled the availability of reinforcement when the therapist was not busy and the absence of the contrived  $S^D$  signaled the unavailability of reinforcement when the therapist was busy. The first and second phases of the BCBC design were replicated in the third and fourth phases, respectively.

**Naturally occurring  $S^D$ s with simple busy/non-busy pairs.** During sessions with naturally occurring  $S^D$ s with simple busy/non-busy pairs, therapist activity type and order were randomized in a similar fashion to baseline procedures described above. Sessions were identical to training sessions in Phase 1 with naturally occurring  $S^D$ s except that after the initial busy/non-busy pair intervals, a new pair was presented. Thus, a total of two new pairs of activities were presented within a session. Sessions began when the therapist entered the session room with the client and materials for the assigned pairs of busy and non-busy activities. If the participant emitted the FCR during a non-busy activity, the therapist provided access to a video for 30 seconds. If the participant emitted the FCR during intervals in which the therapist was engaging in a busy behavior, the therapist ignored the participants' requests. There were no programmed consequences for problem behavior during sessions.

**Naturally occurring S<sup>D</sup>s with difficult busy/non-busy pairs.** Sessions with naturally occurring S<sup>D</sup>s with difficult busy/non-busy pairs were identical to sessions with simple pairs described above, except that pair selection consisted of difficult pairs identified in Table 1. For Bernard, simple discrimination pairs of busy and non-busy therapist activities consisted of cooking vs. sitting doing nothing (Pair 1) and talking on the phone vs. reading a newspaper (Pair 2). Difficult discrimination pairs of therapist busy and non-busy therapist activities consisted of finishing a math assignment sheet for a class vs. completing a Sudoku puzzle game sheet (Pair 1) and filing electronic federal and state taxes on a laptop vs. searching for entertainment news on a laptop (Pair 2).

**Contrived S<sup>D</sup>s with simple busy/non-busy pairs.** During sessions with contrived S<sup>D</sup>s with simple busy/non-busy pairs, therapist activity type and order was randomized in a similar fashion to procedures described above. Sessions were similar to conditions described above for naturally occurring S<sup>D</sup>s except the busy/non-busy activities were paired with the contrived stimulus used in Phase I training conditions. Sessions began when the therapist entered the session room with Bernard and with materials for the assigned pairs of busy and non-busy activities. The therapist presented the same contrived, discriminative stimulus (bracelet) used in the contrived S<sup>D</sup> training of Phase I that signaled when reinforcement was available. The therapist overtly showed the contrived S<sup>D</sup> to Bernard and provided the rule, “When the bracelet is on, you can ask me for the video and I will give it to you. When the bracelet is off, you can ask me for the video, but I will not give it to you.”.

If Bernard emitted the FCR during a non-busy activity (contrived S<sup>D</sup> present), the therapist provided access to the preferred video for 30 seconds. If Bernard emitted the

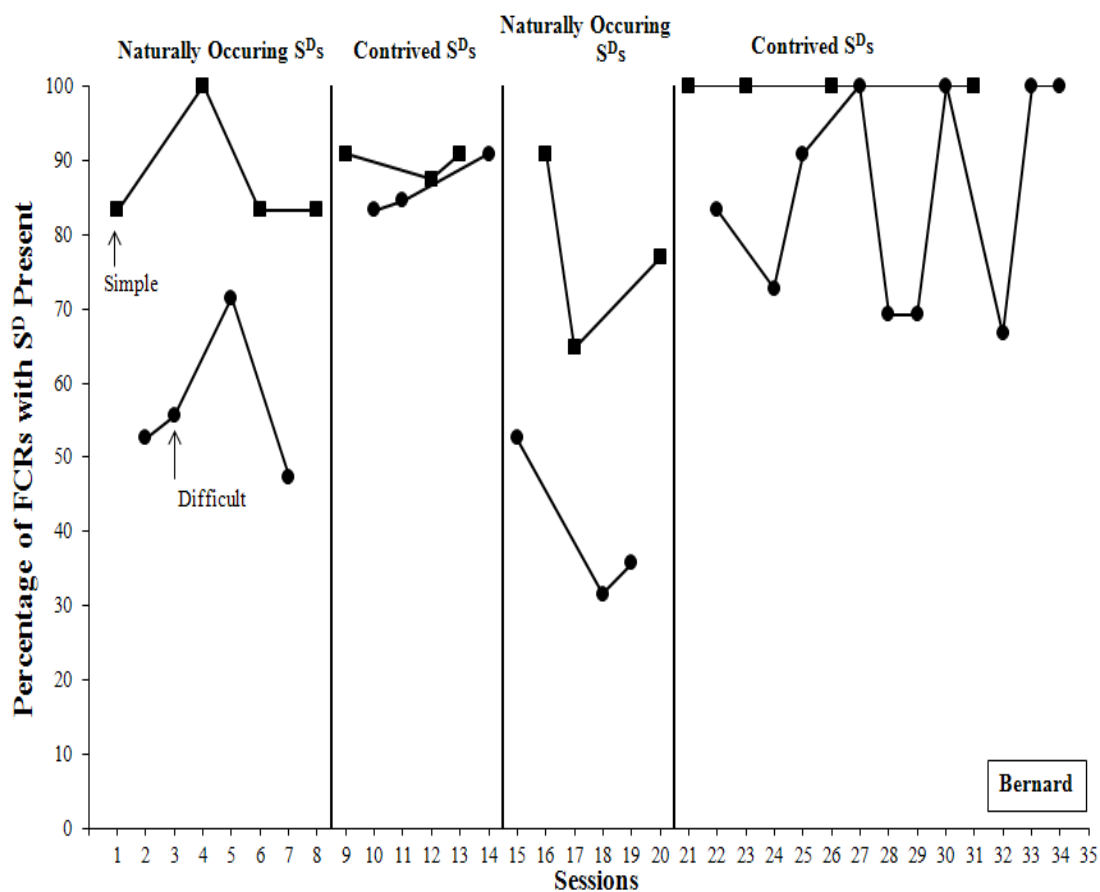
FCR during intervals in which the therapist was engaging in a busy behavior (contrived S<sup>D</sup> absent), the therapist ignored the participant's requests. There were no programmed consequences for problem behavior during sessions.

**Contrived S<sup>D</sup>s with difficult busy/non-busy pairs.** For Bernard, sessions with contrived S<sup>D</sup>s with difficult busy/non-busy pairs were identical to sessions with simple pairs described above, except that pair selection consisted of difficult pairs identified in Table 1.

## RESULTS AND DISCUSSION

The findings for Bernard's post training generalizations probes with naturally occurring and contrived discriminative stimuli across novel difficult and simple discrimination pairs of therapist activities are depicted in Figure 5.

Figure 5. Percentage of Functional Communication Responses for Bernard During Post-Training Generalization Probes for DFCT with Naturally Occurring and Contrived Discriminative Stimuli Across Simple and Difficult Discrimination Pairs.



During the first phase, Bernard allocated more FCRs when the salient  $S^D$  was present when exposed to simple discrimination pairs in the natural occurring  $S^D$  condition ( $M = 87.5\%$ ) than when compared to exposure to difficult discrimination pairs ( $M = 56.7\%$ ). In contrast, Bernard demonstrated near equal and higher rates of responding when simple and difficult discrimination pairs in the contrived  $S^D$  condition ( $M_s = 89.7\%$  and  $82.3\%$  for Simple and Difficult Pairs, respectively). This pattern was again observed when reversing to the natural occurring  $S^D$  condition (Simple Pairs:  $M = 77.5\%$ ; Difficult Pairs:  $M = 39.9\%$ ) and finally the contrived  $S^D$  condition again (Simple Pairs:  $M = 100\%$ ; Difficult Pairs:  $M = 86.5\%$ ). Given the inability to test the effects of training with contrived and naturally occurring  $S^D$ s in novel contexts beyond one participant, the generality of the findings with Bernard are limited. However, the clear differentiation of appropriate allocation of FCRs between the simple and difficult pairs of activities with a contrived  $S^D$  present and the within-subject replication provides convincing evidence of the benefits of using contrived stimuli in schedule thinning to transfer training to novel contexts and more readily discriminate when reinforcement is available.

## GENERAL DISCUSSION

Three participants who exhibited problem behavior were taught to respond with pro-social functional communication responses to gain access to adult attention and/or tangibles (movies or adult attention) when they were available. For one participant, acquisition of the discriminated use of the functional communication response was more rapid in the contrived  $S^D$  condition. Also, he demonstrated significantly greater differentiated responding and more appropriate use of the FCR with novel, simple and difficult discrimination pairs of activities in the presence of the contrived  $S^D$  than when

required to discriminate between therapist activities (naturally occurring  $S^D$ s). For a second participant, training discriminated responding with both naturally occurring and contrived occurring  $S^D$ s was comparably effective. For a third participant, discriminated responding of the FCR for both conditions did not occur until toys were added during the EXT component and which subsequently was confirmed to add a discriminative function to the components of the multiple schedule arrangement.

Together, these findings do not entirely support the expected results as hypothesized. However, aspects of each participant's results do add and/or confirm previous findings in the existing literature regarding multiple schedule training following functional communication training. As exhibited by all three participants, training individuals to observe adult or caregiver actions that serve as discriminative stimuli for when reinforcement is available is possible (Kuhn, 2010). However, as Tiger and Hanley (2004) demonstrated with one subject, similar to Donald in this study, training with terminal schedule values in a multiple schedule arrangement was not successful for achieving discriminated responding in all cases. Furthermore, it was not successful until toys were added to only the EXT component which served a potentially dual role of competing items and whose presence or absence served as an  $S^D$  or  $S^\Delta$ . Similar to procedures and results obtained by Fisher et al. (1998) in which different  $S^D$ s were taught to signal either the exclusive availability of attention or tangibles, training could be employed with subjects that would condition a particular toy for either the availability or unavailability of the functional reinforcer (i.e., reinforcement vs. extinction components). This information is clinically useful in that if a more simplified use of contrived  $S^D$ s (one bracelet taken off or on) is not sufficient for an individual to achieve

discriminated responding with the functional and alternative communication response, gains could potentially be achieved by pairing specific stimuli such as toys (i.e., serving as an  $S^D$  or  $S^A$ ) that are (a) developmentally appropriate and (b) provides the individual with a concurrent, functional activity that competes with problem behavior or manding at inappropriate times.

As mentioned in the results above, the different patterns of responding for each participant during training reduces the generality of the conclusions that can be made concerning the efficacy of one training procedure versus another. This is further impacted by the inability to test the efficacy of participant use of the FCR with both contrived and naturally occurring discriminative stimuli when novel busy and non-busy activities are topographically similar (difficult discrimination pairs) vs. topographically dissimilar (simple discrimination pairs). Thus, although one participant confirmed the hypotheses of the current study, the results of the other two participants warrant continuing these training and test procedures to further determine their efficacy and potential replicability. Thus, this research protocol will remain active and more subjects will be recruited to test the related hypotheses.

In summary, determining the most effective procedures for training alternative communicative responses and their use in natural environments continues to be important for increasing independent functioning of individuals with communication impairments who exhibit severe problem behavior. The current study provides initial findings that for some individuals, there is greater benefit using the technology of contrived stimuli when training individuals to use an FCR in a multiple schedule arrangement for reinforcement thinning, and for transferring the discrimination to new contexts in which it may be



difficult to discriminate untrained stimulus conditions for when reinforcement is available. For example, caregivers and staff in various settings often engage in task or leisure activities that each contain varied contingencies with equally motivating variables. As an extension of one of the difficult discrimination pairs in this study, a mother who sits down at the table to complete her taxes likely has strong motivating operations and contingencies for finishing her e-forms on time. However, the same mother, at other times, may be sitting at the table using her laptop to read the most recent entertainment news. In the latter case, being interrupted her activity to deliver attention or an item is simpler than the former, although both look similar. The benefit of the caregiver signaling the availability of preferred attention or an item in a clear manner, regardless of their activity, is not small. The case of the classroom teacher or staff person is similar. In addition, it is common for individuals who exhibit problem behavior to initially receive treatment in outpatient clinic settings and to later transfer treatment gains to people and settings in the natural environment. Bernard's results would suggest that schedule thinning and establishing discriminated responding for available reinforcers with contrived  $S^D$ s would : (a) require fewer resources spent to access clinical services, and (b) establish treatment gains that are more easily transferred to other settings such as caregivers in homes or schools.

Finally, these initial findings also suggest further research that could determine if using developmentally appropriate preferred items as discriminative stimuli vs. arbitrarily selected stimuli (cards, bracelets, etc.) could facilitate thinning procedures within multiple schedule arrangements for some individuals. That is, discriminated responding for some individuals may not only require presentation of separate and distinct stimuli

that signal reinforcement and extinction, but the stimuli correlated with extinction could also function as a concurrent operant that is functional and socially appropriate (e.g., playing with a particular toy only when reinforcement is not available).

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## BIOGRAPHY OF AUTHOR

Kenneth Douglas Shamlian was born at Ft. Sam Houston in San Antonio, Texas. He earned his high school diploma from Flour Bluff High School in Corpus Christi, TX in 1995, a Bachelors of Science degree with a major in biblical studies from Cairn University in 2000.

After graduation, Mr. Shamlian pursued training and work experience in the education and mental health field. While working with children who had been identified with an emotional or behavioral disability in k-12 programs, in 2005 he also completed a Masters of Education degree from the University of Maine in Counselor Education within the dual tracks of clinical and school counseling. Shortly after realizing his lack of training in empirical approaches to treating behavioral disorders, he pursued his Doctorate of Psychology degree in School Psychology from the University of Southern Maine (USM). During studies at USM, Mr. Shamlian's research and training was primarily within applied behavioral analysis as it applied to various populations. In addition, during this period he had the opportunity to engage in research projects, serve as a guest reviewer for the Journal of Applied Behavior Analysis, serve as a clinical specialist under Dr. F. Charles Mace and Dr. Michael Kelley, and earned his Masters of Science in Educational Psychology from USM in 2010.

During his pre-doctoral internship from 2011 to 2012, Mr. Shamlian had the opportunity to complete an intensive year of training at the University of Nebraska Medical Center's Munroe-Meyer Institute for Genetics and Rehabilitation. Training within the institute consisted of assessment and treatment of severe behavior disorders and early intensive behavioral education within a behavior analytic approach.

Following the completion of degree requirements in 2012, Mr. Shamlian began a post-doctoral fellowship at Nova Southeastern University's Unicorn Children's Foundation Clinic within the Severe Behavior Disorders Program with Dr. Mace. In this position, he serves as a senior behavior analyst for day treatment and intensive outpatient clients with severe behavior disorders. He currently plans to work toward licensure as a psychologist in Florida and securing a faculty position over the coming year.