Assessing the Generality of Gains Made Through Functional Communication Training to Contexts Where Mands and Problem Behavior are Both Reinforced

By

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CHAPTER 1

Introduction

1.1 What is Functional Communication Training?

Functional Communication Training (FCT; Carr & Durand, 1985) is an evidence-based practice (Durand & Moskowitz, 2015) that has been shown to reduce problem behavior and increase functionally equivalent mands across a multitude of ages (e.g., Durand & Carr, 1991) and diagnoses (e.g., Mancil et al., 2006). Specifically, FCT typically begins with the implementation of a functional behavioral assessment to identify what variables are maintaining problem behavior (e.g., access to attention, escape from demands). Next, the individual is taught a mand to gain access to the same reinforcer maintaining problem behavior and the individual is given opportunities to practice manding for reinforcement (Radhakrishnan et al., 2019).

1.2 The Four Phases of Functional Communication Training.

There are four distinct, but inter-related goals of FCT that are typically targeted by researchers. These goals include: (a) the elimination of challenging behavior and the strengthening of mands—hereafter referred to as response elimination (RE), (b) the increase of tolerance to delays and/or denials for the functional reinforcer in the form of continued reductions of challenging behavior during establishing operation (EO) periods—hereafter referred to as EO tolerance, (c) generalized treatment effects to untrained contexts (i.e., generalization), and (d) maintenance of treatment effects after treatment supports have been removed (i.e., maintenance).

Although some researchers have begun to publish evidence of the efficacy of models which strive to achieve all four of these goals through individualized but comprehensive treatment packages (e.g., Lambert et al., in preparation), few researchers have provided evidence of accomplishing all of them within a single study; with compelling demonstrations of generalization and maintenance being particularly wanting (Standish et al., in preparation).

1.3 Promoting Maintenance and Generalization of Functional Communication Training

Notwithstanding, there are a number of strategies which appear to promote generalization and maintenance of treatment effects. For example, techniques which promote EO tolerance, such as schedule leaning, have been associated with generalized outcomes (e.g., Ghaemmaghami et al., 2021). This may be due to the natural contingencies that the client will encounter outside of the clinical realm. That is, it is highly unlikely that a client will receive the programmed reinforcer on an FR1 schedule of reinforcement while outside of the clinical setting. For example, if there is a child that is taught that they can either engage in aggression to gain access to an iPad or ask for the iPad by saying "iPad please," the mand can only be reinforced when the iPad is (a) in an accessible location to the person intended to deliver the reinforcer, (b) when the iPad is charged and (c) in a context where the iPad is an appropriate reinforcer (e.g., in a location where damage is unlikely and delivery of the reinforcer will not likely interfere with others). If these criteria are not met, access to the iPad won't be possible. Due to the volatility of reinforcement contingencies encountered in typical environments, teaching tolerance of delays and denials for functional reinforcers appears to be one way to "inoculate" treatment effects against low fidelity scenarios and to preserve the maintenance of gains established during more controlled phases of therapy (Ghaemmaghami et al., 2021).

Other techniques which can promote generalized outcomes include multiple exemplar training and sequential modification. Specifically, (a) training sufficient stimulus exemplars (e.g., training across tasks); (b) training sufficient response exemplars (e.g., training multiple modalities of the mand; (c) programming common physical stimuli (e.g., ensuring some aspects of the training and generalization settings are the same); (d) programming common social stimuli (e.g., training therapists across training and generalization contexts), (e) recruiting natural consequences, (f) modification of maladaptive consequences (e.g., punishment, extinction), and (g) sequential modification (Falcomata & Wacker, 2012; Ghaemmaghami et al., 2021). Additionally, Fisher et al. (2015) found that thinning schedules of reinforcement while signaling when reinforcement is available (i.e., using multiple schedules of reinforcement) also promoted generalization across settings and therapists.

However, despite the numerous methods for promoting generalization previously mentioned, Standish et al. (in preparation) found that there were large inconsistencies in terms of what the literature considers to be a measure

of generalization. That is, some studies utilized methods that utilized treatment procedures (e.g., prompting, contingency reviews; cf., Hanley et al., 2014), while other studies discontinued treatment procedures in their assessments of generalization (cf., Berg et al., 2007). This is concerning because it is difficult to determine how effective these methods for promoting generalization truly are when treatment procedures are still in effect. Further, some studies employ techniques in which the implementers utilize similar contingencies during generalization probes that were employed during FCT (e.g., FR1 schedules of reinforcement for mands and extinction for problem behavior; cf., Durand & Carr, 1992). Conversely, other studies have employed dissimilar contingencies during generalization probes and FCT sessions (e.g., implementing extinction for both problem and mands during generalization probes; cf., Falcomata et al., 2013). There is limited evidence that studies in the published literature have evaluated the generalized effects of FCT in a manner in which both manding and problem behavior resulted in access to the functional reinforcer during evaluations of generalization. This is concerning because it is likely that implementers outside of the clinical context will reinforce both manding and problem behaviors; therefore it is important that we know what is likely to occur in such contexts.

In summary, FCT has been found to be an effective treatment for (a) reducing problem behavior and (b) increasing mands across a wide range of individuals. However, due to measurement issues discussed in depth by Standish et al. (in preparation), the degree to which treatment effects generalize to untrained environments and maintain after treatment withdrawal is largely unknown. Therefore, the purpose of the current study was to answer the following questions: (a) will FCT treatment effects established by one implementer in one training context generalize to a novel implementer in an untrained context and (b) in cases in which generalization of treatment effects does not occur following FCT, to what extent will a generalization training package (i.e., EO tolerance training, schedule leaning, multiple schedules, sequential modification, and modification of maladaptive consequences) promote generalization to a novel implementer in an untrained context?

CHAPTER 2

Method

2.1 Participants and Settings

Three children were recruited for this study. For children to be eligible, they had to have (a) an intellectual and/or developmental disability diagnosis and (b) the results of a functional analysis (FA) must have implicated that they engaged in problem behavior maintained by at least one social function (e.g., access to attention, access to escape from demands). Additionally, each child's mother was recruited to act as the generalization agent. While this role could have been filled by any person in the child's life in which problem behavior frequently occurred in the presence of, it just so happened that the children's mothers all volunteered to fill this role. Lastly, the older brother of Child 1 was recruited to participate in later stages of the study (i.e., remediation in the generalization context). A person was eligible to partake in the study if they (a) frequently interacted with the child participant, (b) reported that they consistently contacted the child's challenging behavior, and (c) expressed that they had the time and interest needed to complete the study from beginning to end.

Child 1 was a 7-year-old Egyptian Arabic male with an ASD diagnosis who primarily communicated via vocal-verbal communication using full sentences. Child 1 was fluent in English and Arabic. The mother and brother of Child 1 were also of Egyptian Arabic descent. Mother 1 was 36 years old and fluent only in Egyptian Arabic. Thus, communication with the research team was mediated through translation apps, a bilingual paraeducator from the Child 1's school, and Child 1's bilingual siblings. Brother 1 was 17 years old and was fluent in both English and Egyptian Arabic. Child 2 was a 3-year-old male diagnosed with Cornelia de Lange syndrome with visual and auditory impairments and no formal communication system. Mother 2 was a 23-year-old white female who was fluent in English. Child 3 was a 6-year-old boy diagnosed with ASD who communicated primarily via vocal-verbal communication using full sentences. Mother 3 was a 30-year-old white female who was fluent in English.

For all children, one research assistant acted as the therapist during initial training (i.e., during FCT and during instruction in the first context of generalization training [GT]). Two different research assistants acted as therapists during instruction in the second and third GT contexts (see Table 1 for demographic information pertaining to the therapsits). Lastly, each mother served as therapist during generalization probes (GP). Each therapist was assigned a distinct location (e.g., bedrooms, living rooms) and never served as therapist in alternative locations.

2.2 Materials

For Child 1 and Child 3, a laminated picture card representing a break with the words "Break please," was made available for the children to use to mand for a break. The cards were 2 inch by 2 inch in size. For Child 2, a laminated picture card representing toys with the words "Toys please," was made available for Child 2 to mand for his toys. Unlike the other children's cards, however, this card was about 3 inches by 3 inches in size and had blue plastic strips glued to the front of the card so that Child 2 could tangibly feel the card's front surface in case he could not visually see the picture of the toys.

2.3 Response Measurement

Trained observers scored frequency data for problem behavior, mands, and compliance during both discriminative stimuli (S^D) and stimulus delta (S^Δ) periods (described below). We also tracked the latency from session onset to the first reinforcer obtained during each session.

For Child 1, problem behavior included aggression, self-injurious behavior (SIB), property destruction, and elopement. We scored problem behavior each time we observed contextually inappropriate forceful physical contact between Child 1 and another person from 3 inches or more, when we observed forceful contact between the head of Child 1 and a wall, or when Child 1 left a designated area without permission. For Child 2, problem behavior included SIB in the form of hand biting. Problem behavior was scored any time Child 2's hand or finger crossed the plane of his mouth. For Child 3 problem behavior included aggression. We scored problem behavior each time we observed forceful physical and contextually inappropriate contact between Child 3 and another person.

Safety measures were taken to prevent harm to persons involved in the study. Specifically, all sessions were to be terminated immediately if the child engaged in any behavior that resulted in redness or bruising to any person involved in the session (including the child). Additionally, if session needed to be terminated, blocking procedures would be implemented to prevent injury. Fortunately, sessions were never terminated due to safety concerns.

For each child, a mand was scored any time they independently touched a therapist with a picture card, or (for Child 1 and Child 3) when they vocally requested a functional reinforcer (e.g., "toys please"). Reinforcement was scored any time a child could access stimuli functionally related to challenging behavior. Compliance was scored any time a child completed a task within 5 s of its initial request. We reported compliance as a percentage of opportunities by dividing the number of instances of compliance observed during each session by the total number of opportunities to be compliant (i.e., the total number of new demands presented).

2.4 Interobserver Agreement

Research assistants were trained to collect reliability data following procedures outlined by Dempsey et al. (2012). Two independent observers collected data on at least 32% of all sessions across participants (see Table 2). Interobserver agreement (IOA) was calculated between two graduate level research assistants using the mean-count-per interval (10 s) method. Therefore, we calculated IOA by dividing the number of agreements (i.e., when two observers both scored a specific behavior as occurring during a specific 10 s interval) by the total number of agreements and disagreements, and then multiply by 100 to obtain a percent accurate. When IOA fell below 80%, the data collectors involved were retrained to take data for their specific participant by the first author. Retraining involved talking through a session of data collection (i.e., saying which behaviors were being recorded and when), and then having the affected data collector take data on other session(s) without being talked through data collection until the agreement was at least 80.00%. For Child 1, IOA was collected for 37.79% of sessions and the mean IOA score across all data variables was 94.43% (range: 83.33-100.00%). For Child 2, IOA was collected for 32.56% of all sessions and the mean IOA score across all data variables was 95.75% (range: 83.34-100.00%). For Child 3, IOA was collected for 32.00% of all sessions and the mean IOA score across all data variables was 93.15% (range: 82.74-100.00%).

2.5 General Procedures

To test for direct and generalized effects of FCT on child behavior, we conducted a nonconcurrent multiple-baseline-across-participants designs for each context (e.g., FCT). Prior to study onset, participants were randomly assigned to one of three baseline conditions (i.e., 3 sessions, 5 sessions, 7 sessions). Each participant remained on the same tier for all designs. That is, Child 1 was always Tier 1, Child 2 was always Tier 2 and Child 3 was always Tier 3.

The first design assessed the direct effect of FCT and generalization training (GT) (when relevant) on challenging behavior, manding, and compliance (when relevant) in the contexts in which training occurred and when therapeutic contingencies were strictly enforced. The second was used to evaluate the degree to which the effects of direct training generalized to a context in which training did not occur, and in which both manding and challenging behavior were reinforced on FR1 schedules. For two participants (i.e., Child 1 and Child 3), the third was used to explore the degree to which discriminated manding and discriminated compliance (i.e., complying with requests when a therapist wore a bracelet, manding for breaks when the bracelet was taken off), established through precise schedule enforcement during training sessions, generalized to an untrained context in which both manding and challenging behavior were reinforced on FR1 schedules (irrespective of bracelet status). Due to the emergent nature of Child 2's communicative repertoire, we decided against exposing him to EO tolerance training; a decision which precluded him from participating in assessments of the generality of discriminated responding.

All children participated in functional analysis, baseline, FCT, and Generalization Probe (GP) conditions. Child 1 and Child 3 also participated in the GT condition. Any child for whom a therapeutic effect was established (e.g., no challenging behavior, consistent independent manding), also participated in maintenance probes. Generalization probes could be conducted after four distinct milestones (i.e., baseline, post-FCT, post-GT, maintenance). If treatment effects did not generalize during GPs, we provided remedial instruction by training each parent to deliver relevant instructional cues and to enforce therapeutic contingencies in the generalization context until a therapeutic effect could be established.

2.5.1 Functional Analysis

Prior to study onset, we conducted a semi-structured caregiver interview (Hanley, 2012; see Appendix A) and an FA (Iwata et al. 1982/1994) to identify and confirm the sensitivity of challenging behavior to specific social consequences. Session duration of each FA was 5 min, and included three test conditions (i.e., attention, tangible, escape), and one omnibus control (i.e., play). During tests, sessions began with the presentation of a condition-specific EO (e.g., denied attention, denied tangible, demand presentation). Contingent on challenging behavior, therapists delivered programmed consequences (i.e., access to attention, access to tangibles, escape from demands) for 30 s, and then re-presented the relevant EO. Each condition was conducted until either a function could be (a) identified or (b) ruled out (as determined through visual analysis).

2.5.2 Baseline

For each participant, we utilized the relevant FA condition for the initial baseline sessions. However, if more baseline sessions were needed—such as for Child 3—we conducted more baseline sessions to satisfy design requirements. These sessions were conducted in the exact manner as the matching FA condition. That is, for Child 3, demands were presented every 3 to 5s unless problem behavior occurred or the child emitted a mand for a break. If either of these behaviors occurred, a 30 s break from demands was delivered. If Child 3 was non-complaint but did not engage in challenging behavior, he was manually guided to complete the prompted task 5 s after the initial prompt was delivered.

2.5.3 Training

Direct therapy occurred across two general phases (i.e., FCT and GT) initially. Due to a lack of generalized results of FCT following GT and/or maintenance probes, we opted to provide remedial instruction for all three mothers, so that they could enforce therapeutic contingencies and produce therapeutic outcomes for themselves.

All training sessions were preceded by a contingency review and a forced exposure to programmed consequences. That is, the therapist would tell the child that if they wanted the programmed reinforcer, they could ask for it by vocally asking for the reinforcer by saying the relevant programmed phrase or by touching them with the picture card. The therapist would then guide the child to touch the therapist with the picture card and the reinforcer would be delivered.

2.5.3.1 Functional Communication Training.

During this condition, a research assistant with no previous history with their assigned participant outside of baseline sessions conducted FCT in the setting deemed by the research team to be the safest/easiest to control (e.g., a bedroom with furniture removed and/or secured). Following pre-session contingency reviews and forced-choice exposures, the therapist began each session by presenting challenging behavior's EOs (i.e., the presentation of demands, denied access to tangible items). The therapist reinforced the relevant mand on an FR1 schedule of reinforcement and challenging behavior was placed on extinction (i.e., there were no programmed consequences for problem behavior). To establish independent manding, therapists used a progressive time delay (controlling prompts and prompting intervals were individualized on a case-by-case basis) Prompting intervals began at EO onset (i.e., at the beginning of each session and after each reinforcement interval was terminated) and was systematically increased across sessions (Ledford et al., 2018). This condition continued until challenging behavior remained at or below 10% of baseline responding across three consecutive sessions during which at least one mand was emitted during a non-reinforcement period.

For Child 2 and Child 3, initial FCT sessions did not prove to be effective. Therefore, we made function-informed adaptations according to the guiding principles and problem-solving framework presented in Lambert et al. (submitted). The outcome of this process entailed the addition of response blocking contingent on problem behavior (FR1) for Child 2, and the addition of arbitrary reinforcers (i.e., attention, tangibles) to enrich breaks (i.e., escape to attention + tangibles) for Child 3.

2.5.3.2 Generalization Training.

Generalization Training occurred with Child 1 and Child 3 only. We opted not to include GT for Child 2 due to the severity of his problem behavior, as well as the lack of functional communication skills he had prior to the onset of the study. Generalization training entailed two phases: EO tolerance training and multiple exemplar training (described below).

2.5.3.2.1 EO Tolerance.

These sessions were conducted by the FCT therapist in the FCT context and were similar to FCT sessions with the following exceptions: (a) the therapist put on a bracelet (i.e., the S^{Δ}) prior to the beginning of each session

and following completion of each reinforcement interval, (b) the therapist announced that they put the bracelet on, (c) the therapist kept the bracelet on for 15 s (initially) and 30 s (ultimately), (d) the therapist did not reinforce mands while the bracelet was on, and I after removing the bracelet (and announcing that it has been removed), the therapist reinforced the relevant mand on an FR1 schedule while challenging behavior remained on extinction. If a mand did not occur within 10 s of bracelet removal, the therapist delivered a controlling prompt and then reinforced the prompted mand. It is important to note, that prior to each EO Tolerance session, a contingency review was conducted with the child.

This condition ended after each child emitted at least one mand following bracelet removal, while challenging behavior remained at or below 10% of baseline responding, across three consecutive sessions during sessions in which the S^{Δ} was present for 15 s intervals, and then again when the S^{Δ} was present for 30 s intervals.

Due to the intensity of Child 1's aggression with his mother outside of sessions during this phase of instruction, we imbedded a function-based punisher into an individualized levels system (cf. Lambert et al., 2017; Lambert et al., 2021; LeJeune et al. 2019; Randall et al., 2018). In the higher level, Child 1 could access reinforcement according to the contingencies stipulated in the paragraphs above. In the lower level, the therapist presented the S^{Δ} (i.e., bracelet on wrist) and a resetting visual timer. While in the lower level, challenging behavior's EOs [i.e., demands, denied access to tangible items]) were continuously present.

Levels descension was contingent upon problem behavior according to an FR1 schedule. Levels ascension entailed removal of the visual timer and the S^{Δ}, but not EO (which was still only removed contingent upon manding). Levels ascension occurred contingent upon satisfaction of a conjunctive schedule requirement (i.e., 30-s momentary resetting DRO for challenging behavior; FR3 compliance with simple task demands). Mastery criteria for Child 1 remained the same as described above.

2.5.3.2.2 Multiple Exemplars.

During multiple exemplar training, EO-tolerance training methods described above were replicated by two novel therapists in two novel contexts (labeled GT2 and GT3 in all graphs). Both GT2 and GT3 ended after each child emitted at least one mand following bracelet removal, while challenging behavior remained at or below 10% of baseline responding, across three consecutive sessions during sessions in which the S^{Δ} was present for 15 s intervals, and then again when the S^{Δ} was present for 30 s intervals in each respective context (i.e., GT2 and GT3).

2.5.3.2.3 Generalization Probes

All GP sessions were conducted by the children's mothers. The GP therapist never served as therapist during FCT or GT. Additionally, all GP sessions were conducted in a separate environment than FCT and GT. Two types of GP sessions were conducted for Child 1 and Child 3; one with an S^{Δ} (e.g., a period in which a bracelet was worn) and one without an S^{Δ}. For Child 2, we opted to only conduct GP sessions without an S^{Δ} due to the child's lack of communication skills prior to the study and the severity of his problem behavior. That is, we thought it was best for the child to simply learn to communicate his basic needs rather than learn to tolerate periods of denials for his requests.

During all probes, the relevant stakeholder did not provide any contingency reviews, or forced-choice exposures prior to sessions, or prompts during sessions. Sessions began when the GP therapist presented challenging behavior's EO. For Child 1 and 3, this was the presentation of demands, and for Child 2, this was the removal of preferred toys. Contingent upon an occurrence of either challenging behavior or the relevant mand, the stakeholder would deliver the programmed consequence (i.e., access to break or tangible items) for a specified duration (i.e., 30 s break from demands or 45 s access to toys) according to an FR1 schedule of reinforcement. Following each reinforcement interval, this stakeholder re-presented the relevant EO.

During GP-S^{Δ} probes, the caregiver alternated between presenting and removing the stimulus delta (i.e., bracelet) every 30 s. Problem behavior and mands continued to be reinforced according to an FR1 schedule at all times. That is, regardless of the status of the bracelet, both mand and problem behavior were always reinforced. With the exception of initial probes (whose duration depended on which tier of the multiple baseline the Child was assigned), we conducted three GP sessions per probe.

2.5.3.3Maintenance Probes

Seven to twenty-two days after post FCT-generalization probes (Child 2), or post GT-generalization probes (Child 1, Child 3) were conducted, the FCT therapist conducted maintenance probes in the FCT context. Maintenance probes were similar to generalization probes in that instruction was not provided and therapeutic contingencies were not enforced. Rather, both manding and challenging behavior were reinforced on an FR1 schedule.

If any therapeutic effect appeared to generalize during GP probes for any participant, the GP therapist also conducted maintenance probes in the GP context. However, unlike GP sessions, we did not continue to conduct maintenance probes for three consecutive sessions the moment it became clear therapeutic trends would not maintain (e.g., one session with high rates of challenging behavior and little to no manding).

2.5.3.4 Remediation in Generalization Context

Across tiers, treatment effects either did not generalize, or persist, in generalization contexts when parents were not trained to enforce therapeutic contingencies. Thus, in this phase, we trained all parents to implement with fidelity all instructional methods (e.g., contingency reviews, prompting systems) and to enforce all programmed contingencies (e.g., reinforcing mands on an FR1 in the absence of an S^{Δ}, placing challenging behavior on extinction or punishing it on an FR1) until therapeutic effects were consistently observed in their presence.

During this phase for Child 1, the research team periodically interspersed sessions conducted by his mother and brother with sessions conducted by the research team. Further, they increased S^{Δ} periods from 30 s to 5 min in the higher level of his levels system, began introducing periods of time in which he needed to successfully tolerate EOs for the attention and escape functions of his challenging behavior, and paired these requirements with a visual activity schedule.

When challenging behavior persisted and intensified for Child 1's mother, and elopement started to occur, we replaced the "contingent EO" punishment procedure (i.e., removal of tangibles and presentation of demands contingent on problem behavior) with planned ignore for aggression (30 s DRO), followed by the re-presentation of original demands pre-requisite to reinforcer access stipulated by the visual schedule. When Child 1 eloped, we did not chase him. Rather, we imposed a response cost procedure in which the therapist started a visual timer which accumulated time until Child 1 returned to the designated area. After Child 1 completed his work requirement and his visual schedule indicated he had earned reinforcement, the time accumulated on his visual timer was deducted from reinforcer access time (set to 5 min when no deductions were imposed).

Like we did for Child 1, the team periodically interspersed sessions conducted by the mothers of Child 2 and Child 3 with sessions conducted by the research team. For Child 2, we also began giving his mother "homework" assignments and asked her to conduct 10 trials of FCT + response blocking in a massed-trial format outside of our formal appointments every single day (data available upon request). Although we gave the mother of

Child 3 a similar assignment, rates of aggression directed toward her whenever she presented the FCT paradigm in our absence led us to rescind this request.

Although Child 3 consistently manded for functional reinforcers in the absence of challenging behavior for any member of the research team, he continually refused to mand for reinforcement when his mother served as therapist and began engaging in high intensity aggression and property destruction when she attempted to enforce S^{Δ} contingencies during S^{Δ} probes. Due to the emotional strain that these sessions caused Child 3's mother and the fact that she was disinclined to require EO tolerance in our absence, we temporarily eliminated S^{Δ} from her sessions and introduced a fading protocol in which researchers conducted the first 4 trials of any 5-trial block of FCT (i.e., sessions in which mands produced reinforcement on an FR1). After every session in which Child 3 independently manded for reinforcement during at least one trial in which his mother served as therapist, we increased her role in FCT sessions by adding to the number of trials she presented during each 5-trial block (i.e., the last 2 trials, the last 3 trials, the last 4 trials, all trials in a session). Unfortunately, due to environmental factors outside of our control (e.g., Covid), we were unable to finish all goals with Child 3 and his mother.

2.5.4 Procedural Fidelity

For procedural fidelity, data were collected on steps correctly implemented. That is, data were collected via whole interval recording using 10 s intervals. If all relevant procedures (e.g., reinforcer deliver) were followed for the entire interval, we scored the interval as correct. Otherwise, we scored it as incorrect. The total number of correctly implemented intervals were then divided by the total number of intervals and multiplied by 100 to achieve a percentage. Procedural fidelity was collected for at least 30% of all sessions across all participants. Fidelity data are displayed in Table 3. For Child 1, procedural fidelity was collected for 52.17% of sessions and the mean procedural fidelity score across all data variables was 96.70% (range: 72.50-100.00%). For Child 2, procedural fidelity was collected for 30.23% of all sessions and the mean procedural fidelity score across all data variables was 98.48% (range: 80.00-100.00%). For Child 3, procedural fidelity was collected for 32.00% of all sessions and the mean procedural fidelity score across all data variables was 97.32% (range: 85.71-100.00%).

Table 1.

Demographic Information for Therapists.

Associated Participant	Age	Race/Ethnicity	Gender Identity	Fluent Languages
Child 1	22	White/Hispanic	Female	English
Child 1	23	White	Female	English
Child 1& 2	39	White/Latinx	Male	English, Portuguese, Spanish
Child 2 & 3	32	White	Female	English
Child 3	22	Indigenous/Latina	Female	English, Spanish
Child 3	23	White	Female	English

Note. Race and ethnicity listed are listed in the manner that the therapist self-identified.

Table 2.

Interobserver Agreement

Participant (% Collected)	Problem Behavior: Average (Range)	Mand (S^D): Average (Range)	I-Mand (S^Δ): Average (Range)	Comply (S^D): Average (Range)	Comply (S^Δ): Average (Range)	Mean
Child 1 (37.89%)	97.02% (76.39-100%)	95.35% (83.33-100%)	93.92% (0.00-100%)	97.97 (66.67-100%)	87.80% (40.00-100%)	94.43%
Child 2 (32.56%)	96.34 (75.00-100%)	94.34% (73.33-100%)	N/A	N/A	N/A	95.75%
Child 3 (32.00%)	87.93% (58.73-100%)	98.70% (93.33%)	98.72% (86.67%)	97.36% (75.00-100%)	92.55% (75.56-100%)	93.15%
Mean	93.76%	96.13%	96.32%	97.65%	90.18%	94.44%

Note. S^D = discriminative stimuli. S^Δ=stimulus delta

Table 3.

Procedural Fidelity

Participant (% collected)	PF Average (Range)
Child 1 (52.17%)	96.70% (72.50-100.00%)
Child 2 (30.23%)	98.48% (80.00-100.00%)
Child 3 (32.00%)	97.32% (85.71-100.00%
Average	97.50%

Note. PF= procedural fidelity

CHAPTER 3

Results

The results of all three FAs are displayed in Figure 1. For Child 1, we observed elevated rates of problem behavior in the escape condition as compared to the other conditions. This indicated that the function of problem behavior for Child 1 was escape from demands. While there may have been other functions present as well (i.e., tangible), we opted to treat the escape function only as it was the condition in which problem behavior was consistently at the highest rates. For Child 2, FA results indicated a tangibles function. Again, once more a secondary function (i.e., attention) may also have been present, but we opted to treat the tangible function as it was the condition in which problem behavior most reliably occurred in. The results of the FA with Child 3 indicated that there was an escape from demands function.

Comprehensive graphs displaying child performance across all phases of this study are displayed in Figure 2 (Child 1), Figure 3 (Child 2), and Figure 4 (Child 3). A three-tier multiple baseline evaluating control of FCT over challenging behavior and manding in training contexts is displayed in Figure 5. A two-tier multiple baseline evaluating control of GT over discriminated manding and discriminated compliance in training contexts is displayed in Figure 6. A three-tier multiple baseline evaluating the generality of reductions in challenging behavior and manding to unsignaled generalization contexts is displayed in Figure 7. A two-tier multiple baseline evaluating the generality of reductions in challenging behavior, discriminated manding, and discriminated compliance in unsignaled generalization contexts is displayed in Figure 8.

3.1 Training

3.1.1 Functional Communication Training

During baseline sessions for Child 1, we observed elevated rates of problem behavior, no instances of independent manding, and moderate rates of compliance (Figures 2 & 5). During FCT, we observed independent

manding emerge and problem behavior reduce to zero rates; however, compliance was also reduced to zero rates. This is not surprising, however, because compliance is functionally incompatible with mands for breaks, which were reinforced on an FR1 schedule in this condition. That is, because Child 1 engaged in such high rates of independent manding, there were few opportunities for compliance to occur and compliance was not necessary.

During baseline sessions for Child 2, we observed high levels of problem behavior and no instances of independent manding (Figures 3 & 5). During initial FCT sessions, we observed high rates of independent manding; however, problem behavior was also occurring at high rates. Following the introduction of response blocking, we observed lower rates of problem behavior and independent manding persisted. Therefore, the goals of FCT were obtained. Specifically, we observed a 97.50% reduction in problem behavior in the final three FCT sessions as compared to the final three baseline sessions.

During baseline sessions for Child 3, Child 3 was both compliant and aggressive and never manded for breaks (see Figures 4 & 5). During FCT, problem behavior reduced to zero but independent manding did not consistently occur (i.e., reinforcement was obtained through prompted manding) and compliance remained high. Following the introduction of enriched breaks (i.e., escape to tangibles + attention), rates of independent manding increased, compliance dropped to zero, and problem behavior remained low.

3.1.2 Generalization Training

During initial GT sessions for Child 1, we observed consistent compliance with demands in both signaled and unsignaled periods, along with low rates of high intensity aggression (Figures 2 & 6). Upon introduction of the individualized levels system, compliance temporarily decreased and rates of aggression temporarily increased. Eventually, aggression reduced to zero and discriminated manding emerged, but discriminated compliance did not (i.e., Child 1 engaged in variable rates of compliance in both signaled and unsignaled periods). When Child 1 was exposed to GT2, aggression remained at zero rates and both discriminated manding and discriminated compliance were observed. During GT3, no aggression was observed and discriminated manding and compliance both persisted. During GT for Child 3, discriminated manding and discriminated compliance emerged for all three therapists in all three settings with little to no challenging behavior (Figures 4 & 6).

3.1.3 Maintenance

Seven days after we completed GT, we conducted Child 1's maintenance probes (Figures 2 & 6). Despite the fact that therapists no longer implemented treatment components and reinforced both challenging behavior and manding on FR1 schedules, challenging behavior remained low and both discriminated manding and discriminated compliance maintained.

Eleven days after we completed FCT, we conducted Child 2's maintenance probes (Figures 3 & 5). When therapists stopped response blocking and reinforced both manding and problem behavior on FR1 schedules, challenging behavior immediately returned and manding dropped to near zero levels.

Twenty-two days after we completed GT for Child 3, we conducted his maintenance probes (Figures 4 & 6). Like Child 1, Child 3 continued to engage in low rates of problem behavior, discriminated manding, and discriminated compliance despite the fact that treatment contingencies were no longer enforced and both problem behavior and manding were reinforced on an FR1.

3.2 Generalization Probes

3.2.1 Unsignaled Generalization Probes

The results of the unsignaled GPs for Child 1 are displayed in Figures 2 and 7. During the unsignaled GP baseline, independent manding did not occur and Child 1 engaged in considerably higher rates of challenging behavior when his mother acted as therapist, relative to when a researcher acted as therapist during baseline in the training context. Following FCT, reductions in challenging behavior and increases in manding achieved in the training context generalized to his mother in the unsignaled GP context. However, this effect did not sustain across study phases. During post-GT probes, Child 1 stopped manding and by the end of maintenance probes challenging behavior had returned and was occurring exclusively in this context. For Child 2 (Figures 3 & 7) and Child 3 (Figures 4 & 7), reductions in challenging behavior and increases in manding achieved in the training context never generalized to their mothers during unsignaled GPs.

3.2.2 Signaled Generalization Probes

During the signaled GP baseline sessions and post-FCT sessions (which functionally served as an extension of baseline for these probes) for Child 1, challenging behavior occurred in 5 of 6 probes, discriminated manding did not occur (i.e., he either did not mand or manded during S^{Δ} periods in addition to manding during S^{D} periods), and compliance did not occur (Figures 2 & 8). During post-GT probes, discriminated manding and discriminated compliance achieved in the training context briefly generalized to Child 1's mother. However, by the third post-GT probe, both manding and compliance dropped to zero. During maintenance probes, no manding or compliance occurred and challenging behavior was again observed.

During Child 3's signaled GP baseline and post-FCT sessions, challenging behavior consistently occurred and manding never occurred. Although compliance was observed during baseline, it ceased to occur during post-FCT probes. Because challenging behavior continued to occur during post-GT probes and discriminated manding and discriminated compliance never generalized to Child 3's mother, we did not ask Child 3's mother to conduct maintenance probes.

3.3 Remediation in Generalization Context

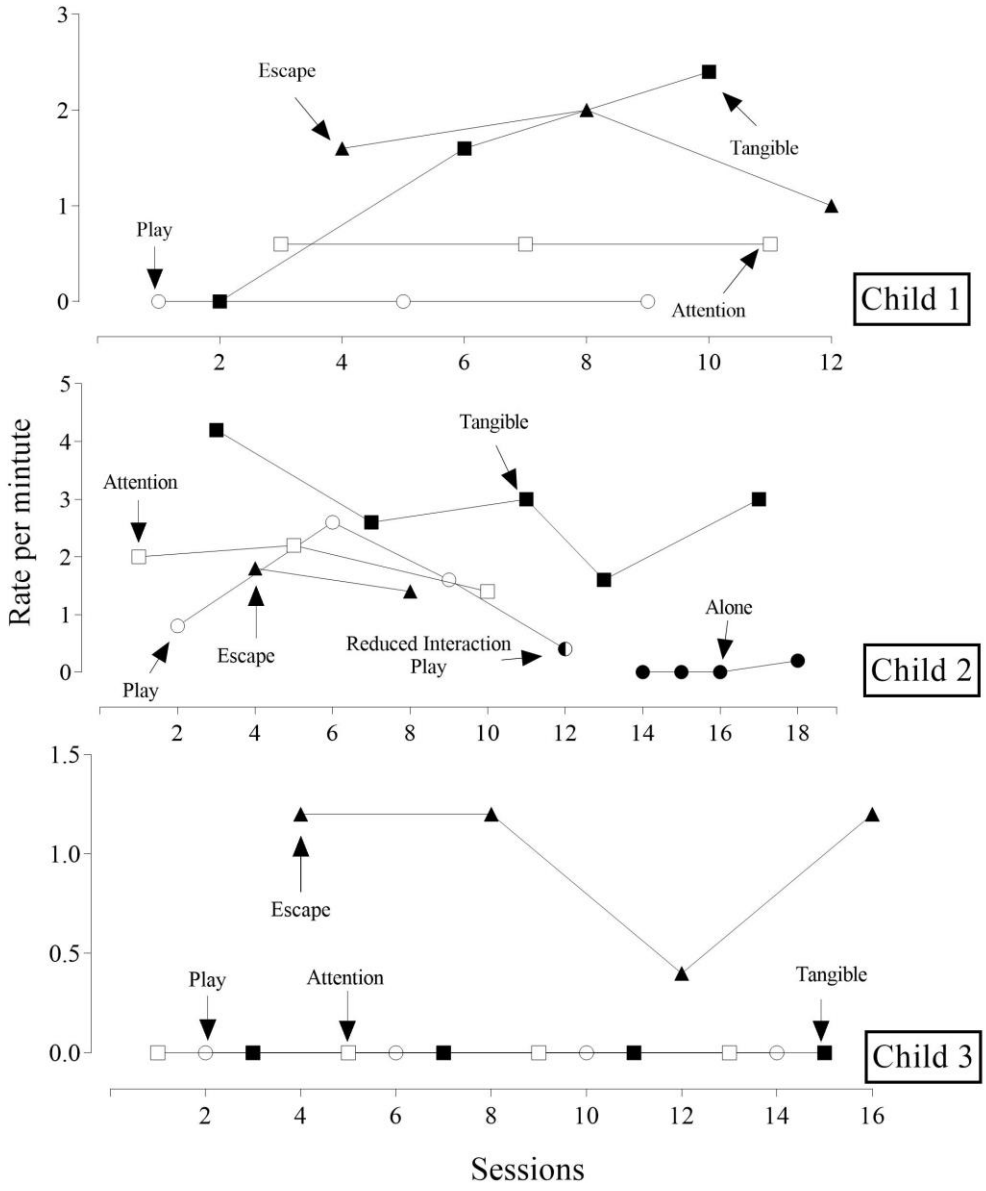
The results of remediation training for the mother of Child 1 are shown in Figure 9. After Child 1 ceased to aggress toward her and started independently manding in her presence during simple FCT, we trained her to implement Child 1's individualized levels system and EO-tolerance protocol. However, due to increases in rate and intensity of aggression, we allowed Child 1's mother to stop conducting sessions until we could re-establish therapeutic gains both with Child 1's brother, and with members of our researcher team. Then, we periodically asked Child 1's mother to conduct probe sessions with high fidelity until all treatment effects consistently occurred in her presence.

The results of remediation training for the mother of Child 2 are shown in Figure 10. After Child 2's treatment had been withdrawn during maintenance probes, challenging behavior persisted when his mother began to implement the intervention, as well as when the research team implemented sessions. After Child 1's mother began to complete her homework sessions, therapeutic effects were re-established for the research team and were finally achieved for his mother. Therapy for this child continued after study offset.

Initial results of remediation training for the mother of Child 3 are shown in Figure 11. After resetting the prompting intervals to zero in a simple FCT context, challenging behavior finally dissipated when this mother served as therapist and independent manding emerged. Therapy for this child continued after study offset.

3.4.1 Figure 1

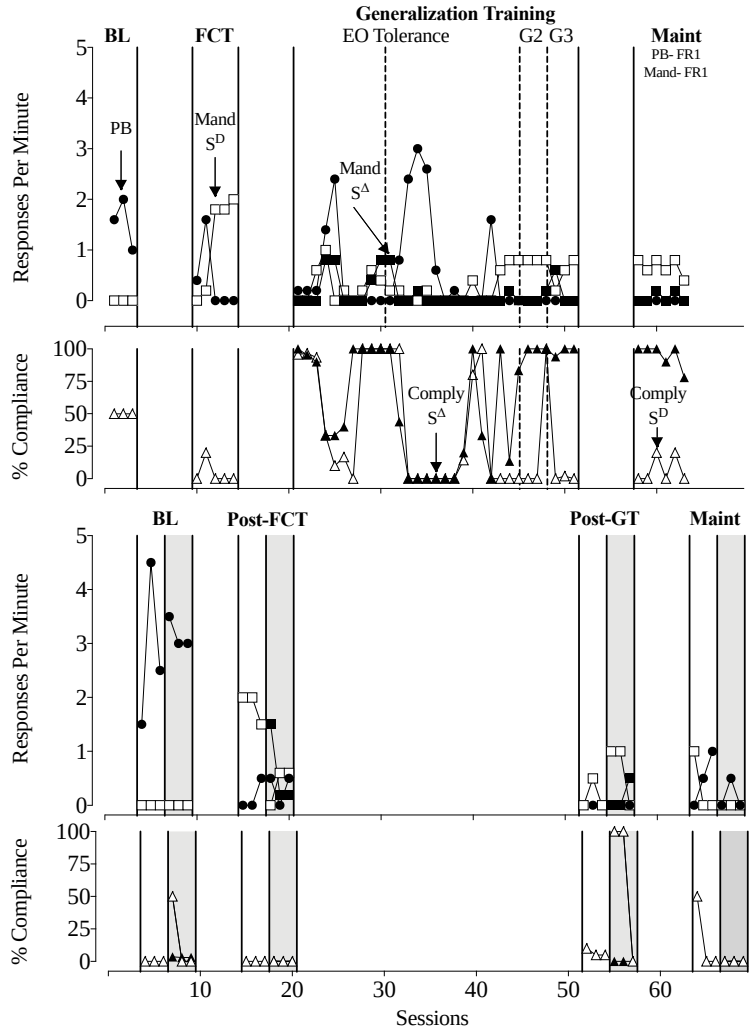
Functional Analysis Results



Note. Each condition was conducted until it could either be confirmed as a function or ruled out as a function for the child's problem behavior.

3.4.2 Figure 2

Temporal Progression of Child 1 Throughout the Study



Child 1

Direct Training

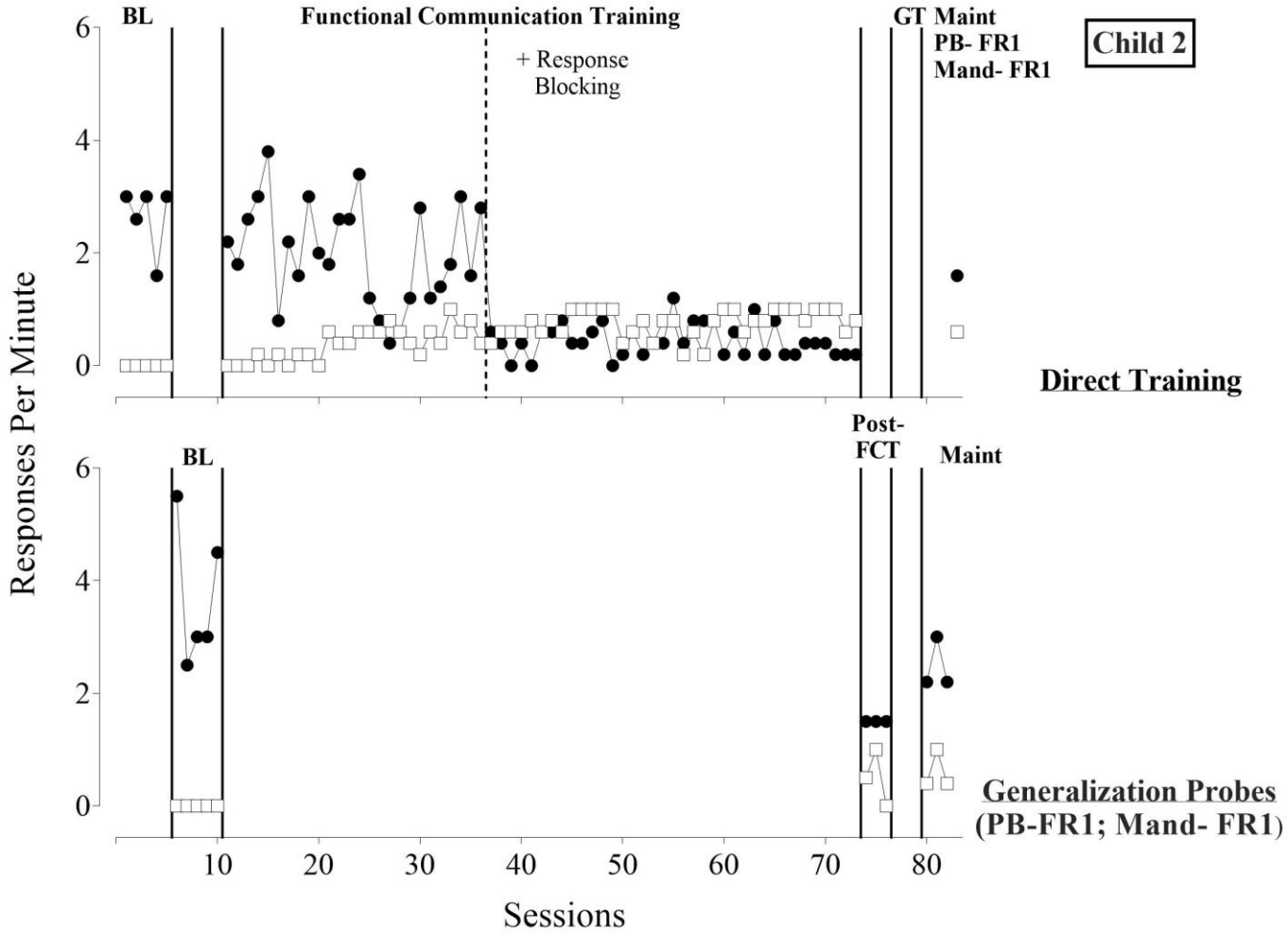
Conditions with no shading = Unsignaled GP
Conditions with gray shading = Signaled GP

Generalization Probes
(PB- FR1; Mand-FR1)

Note. The top panels depict responding with the research team, while the bottom panels depict responding with the mother of Child 1.

3.4.3 Figure 3

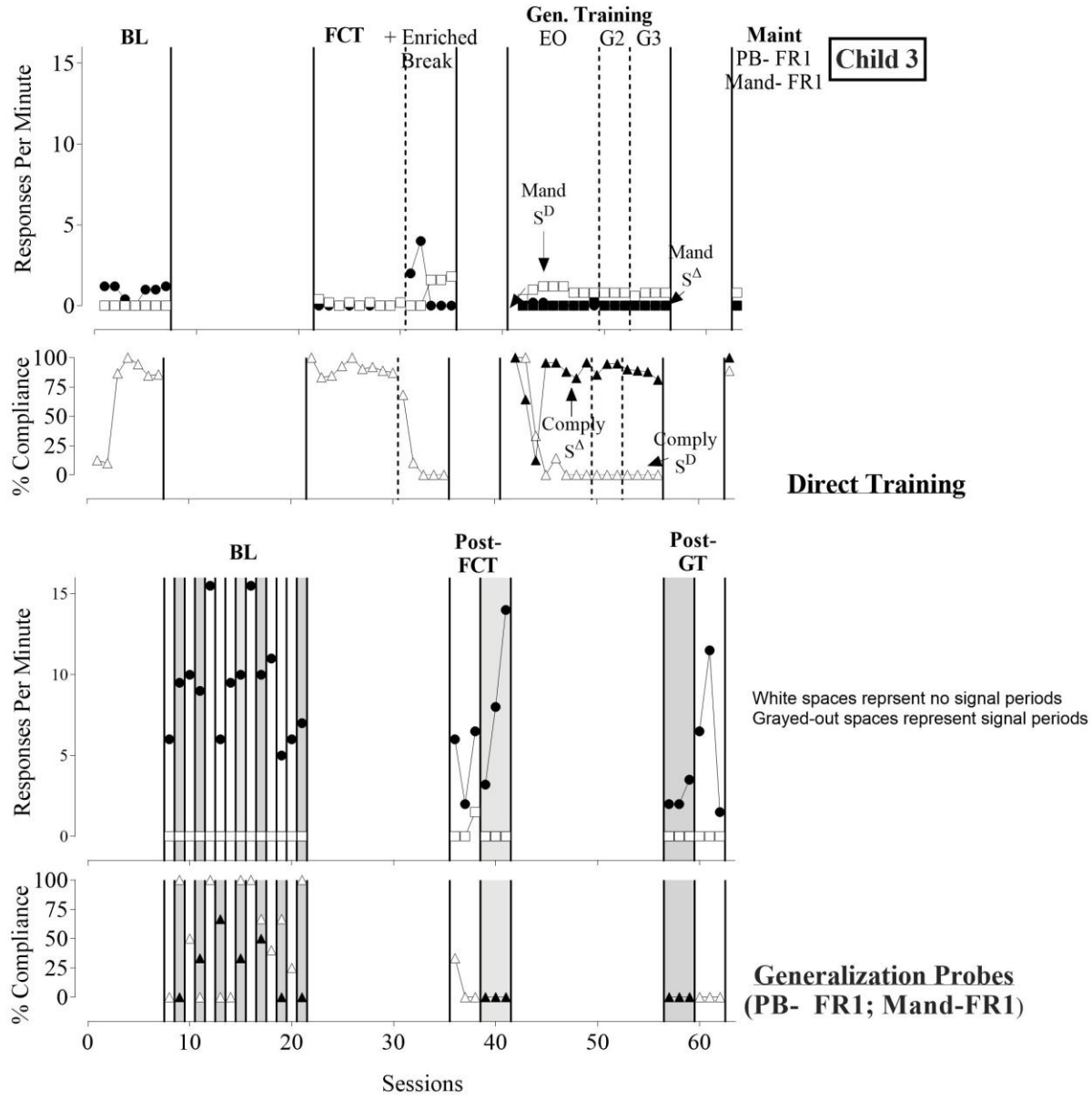
Temporal Progression of Child 2 Throughout the Study



Note. The top panels depict responding with the research team, while the bottom panels depict responding with the mother of Child 2.

3.4.4 Figure 4

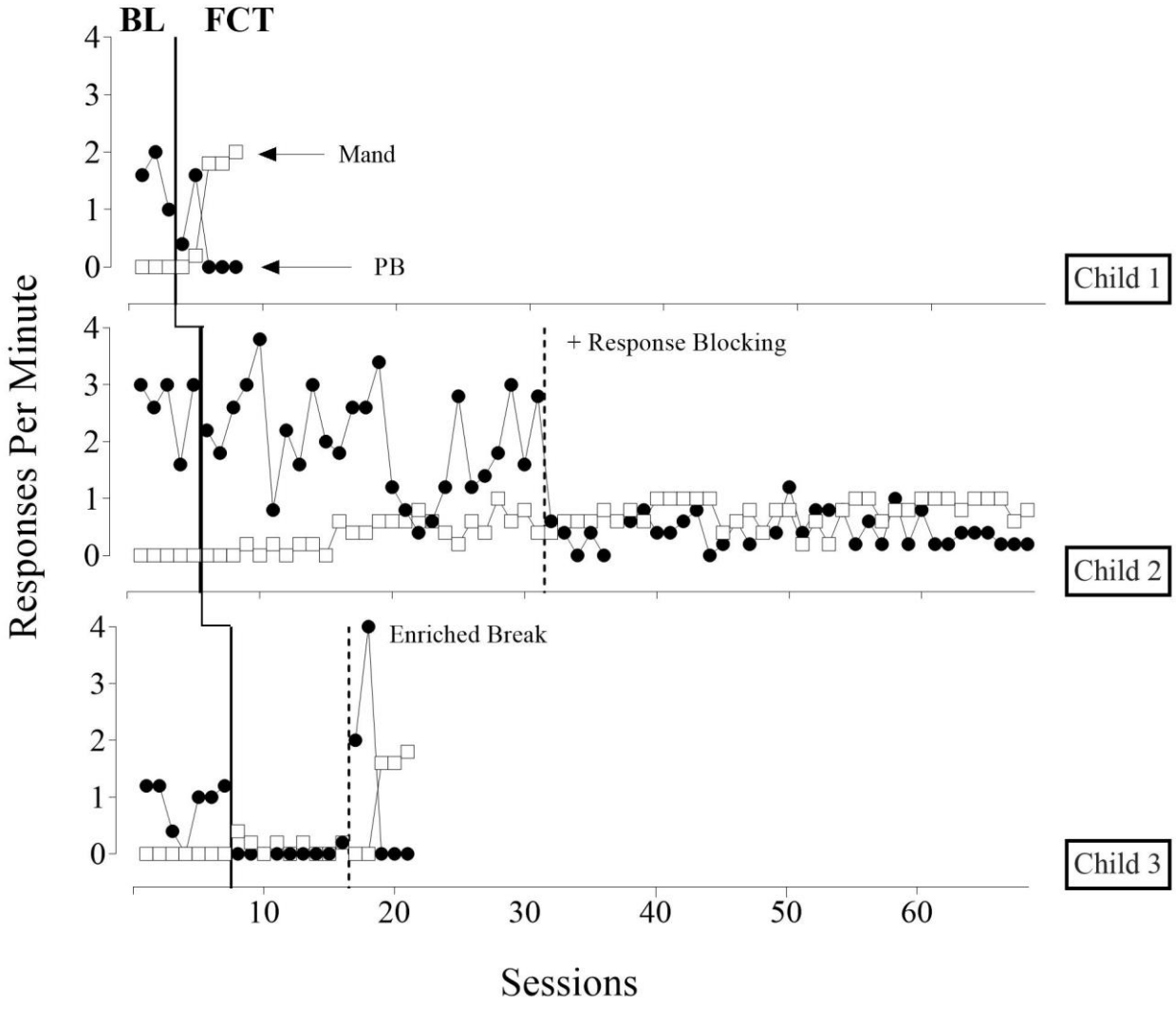
Temporal Progression of Child 3 Throughout the Study



Note. The top panels depict responding with the research team, while the bottom panels depict responding with the mother of Child 3.

3.4.5 Figure 5

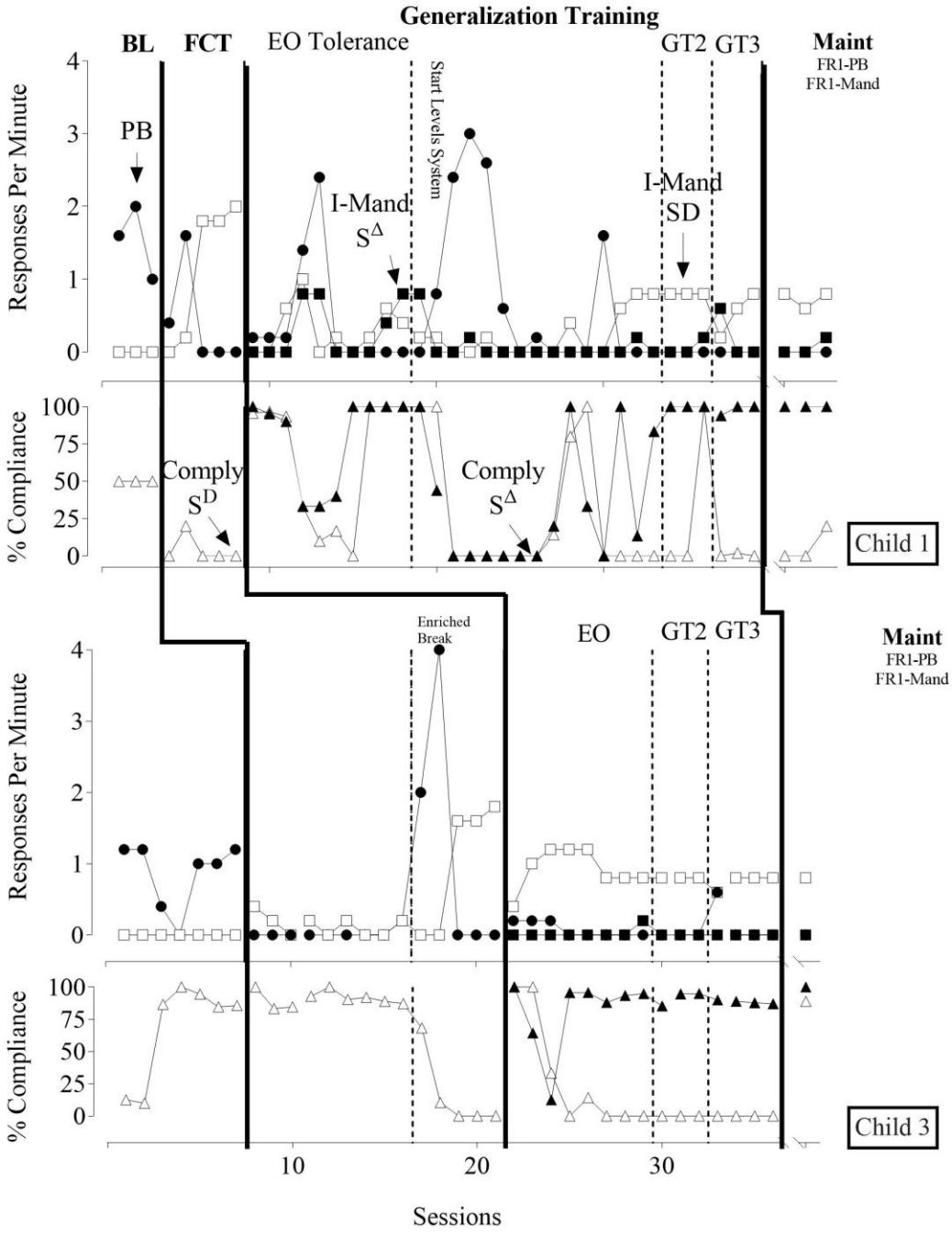
Multiple Baseline Across FCT Planes of Analyses



Note. Data in these graphs only depict responding prior to the implementation of the GT package.

3.4.6 Figure 6

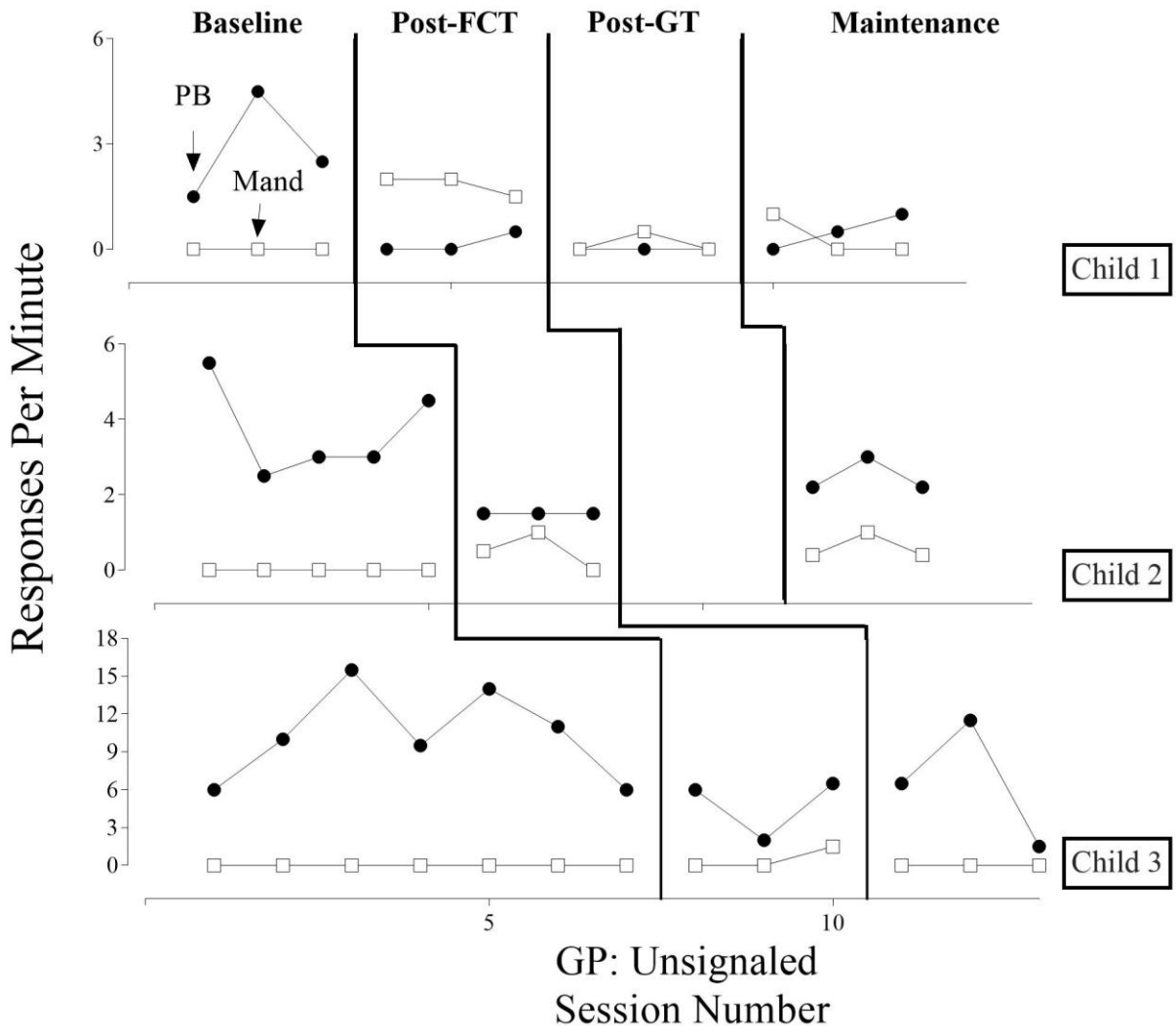
Multiple Baseline Across FCT, GT, and Maintenance Planes of Analyses



Note. Data in the top and third panels represent problem behavior and manding, while data in the second and last panels represent compliance.

3.4.7 Figure 7

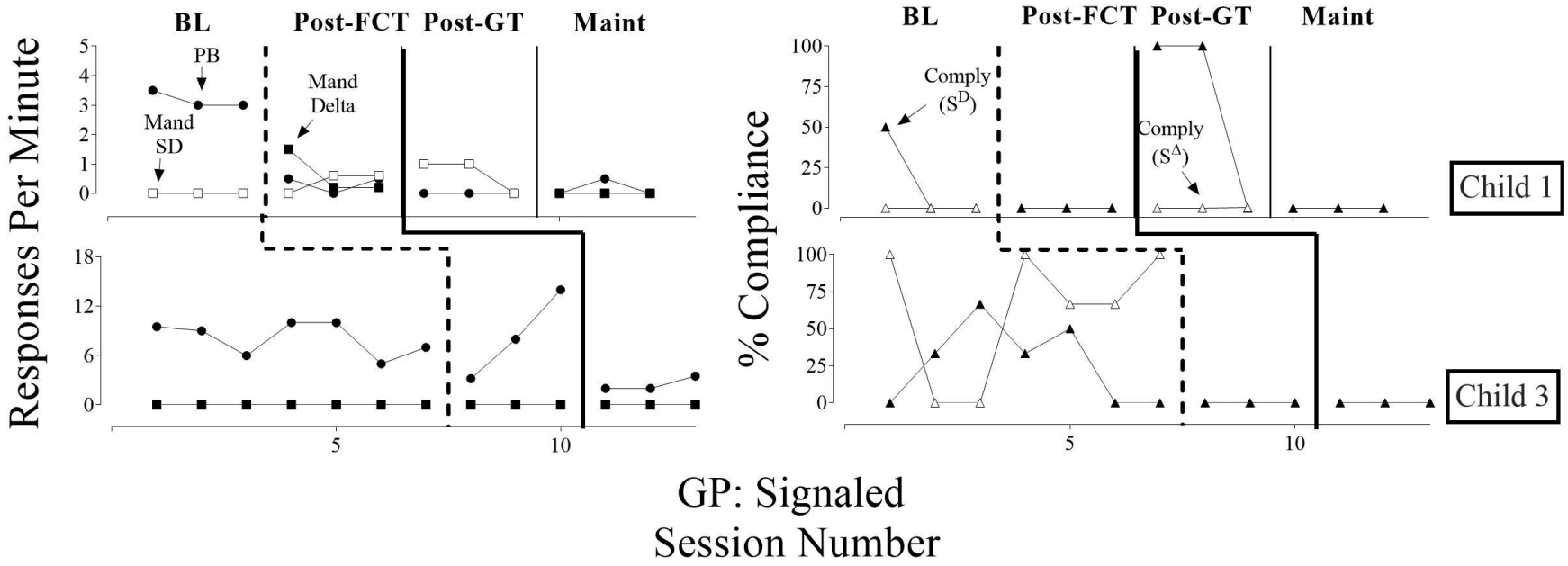
Responding across the Unsignaled GP Planes of Analyses



Note. Data only represents responding in the unsignaled GP planes of analyses. No data were obtained for Child 2 during the GT phase, and no data were obtained for Child 3 in the maintenance phase.

3.4.8 Figure 8

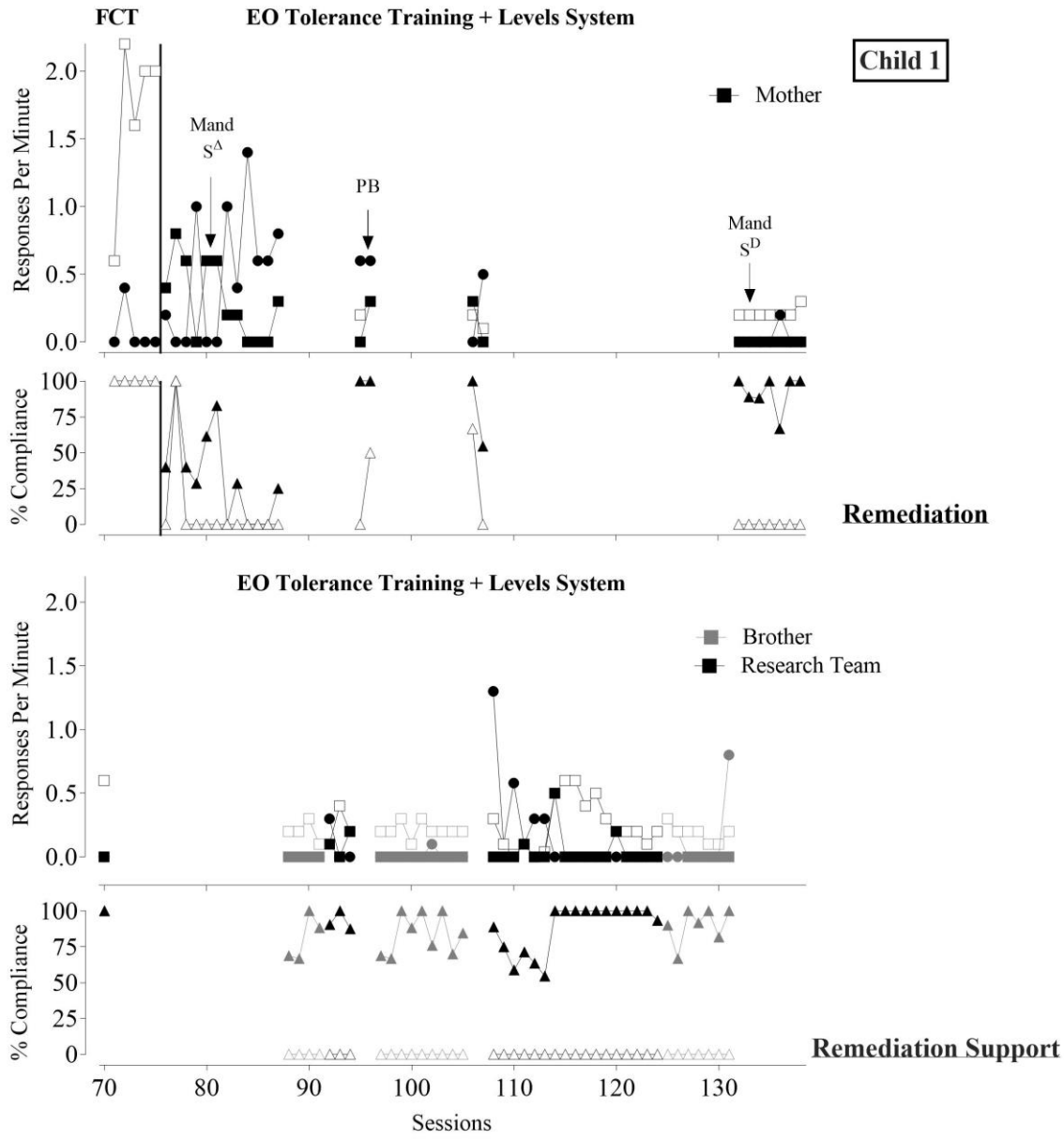
Responding Across the Signaled GP Planes of Analyses



Note. Data were only obtained in these fields for Child 1 and Child 3.

3.4.9 Figure 9

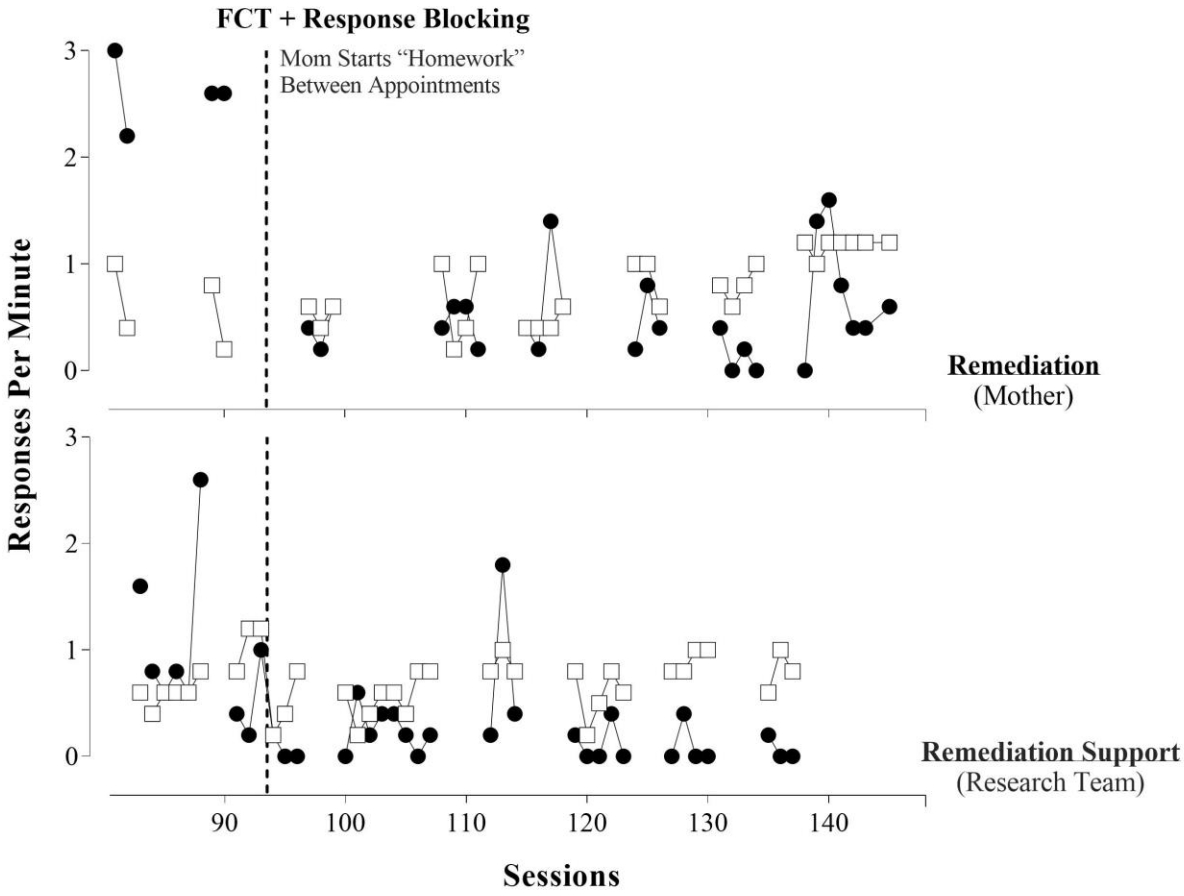
Responding During Remediation for Child 1



Note. Gray data represents data obtained with the brother implementing sessions.

3.4.10 Figure 10

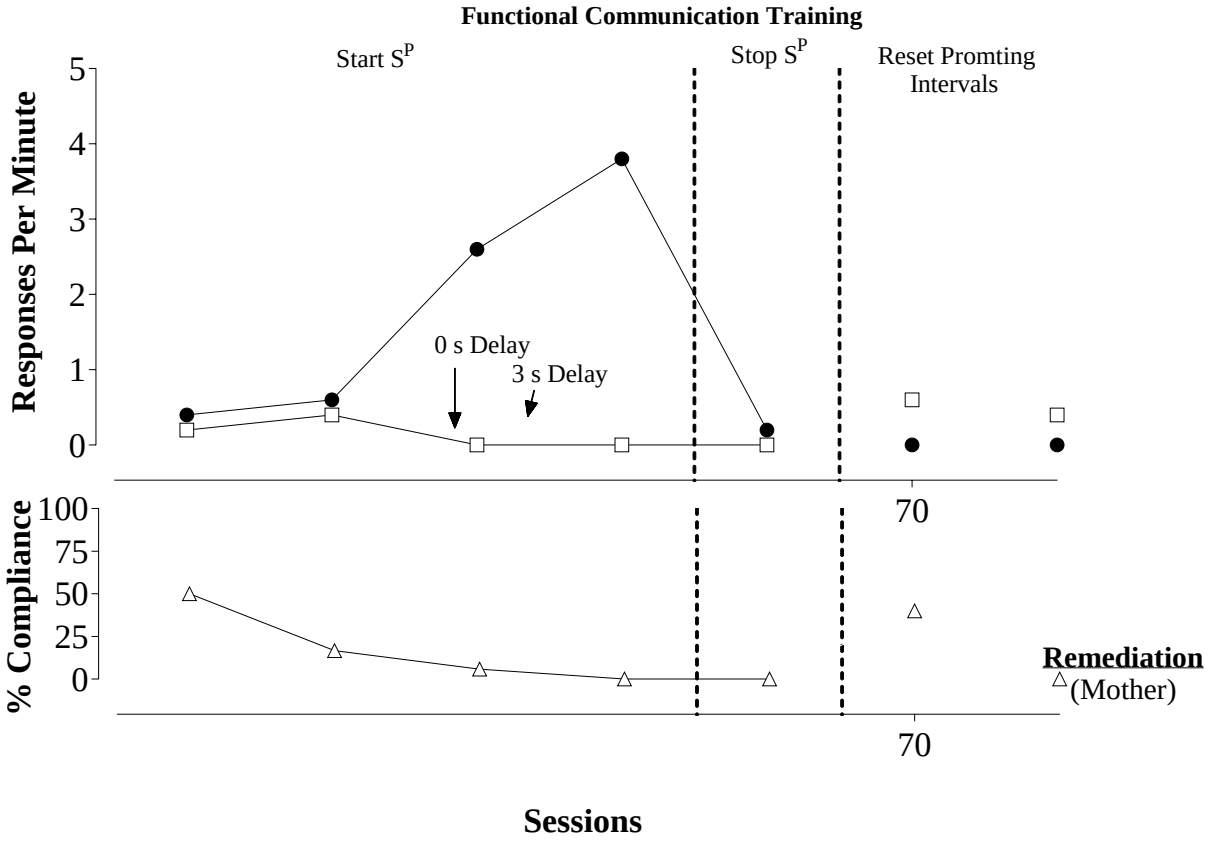
Responding During Remediation for Child 2



Note. Data on the top graph depicts data obtained with the mother was implementing sessions, whereas data on the bottom graph depict sessions in which the research team implemented sessions.

3.4.11 Figure 11

Responding During Remediation for Child 3



Note. EO tolerance phase was not implemented due to environmental variables outside of our control (e.g., Covid).

CHAPTER 4

Discussion

4.1 General Discussion

The purpose of this study was to determine if FCT implemented by one person in a specific context would generalize to another person in a generalization context in which therapy was never implemented and in which therapeutic contingencies were not strictly enforced (i.e., both challenging behavior and manding were reinforced on an FR1). We also asked to what extent FCT would generalize following a generalization training package (i.e., EO tolerance training, multiple exemplar training through sequential modification, and schedule leaning).

Interestingly, we observed higher rates of problem behavior across GP baseline sessions for all participants as compared to the rates of problem behavior observed with the research team during baseline sessions. As noted by St Peter Pipkin & Vollmer (2009), reinforcement histories can directly affect present responding. Combined, this may indicate that parents' histories of reinforcing problem behavior may result in higher rates of problem behavior in their presence as compared to rates of problem behavior with individuals who have shorter reinforcement histories in terms of reinforcing problem behavior. While this is not surprising, it is unknown how common this phenomenon is as most FCT generalization studies do not utilize baseline data with parents (cf., Durand & Carr., 1991), but rather compare rates of problem behavior with the research team to the rates observed with the generalization agents.

Following the implementation of training FCT contingencies with the research team, we observed rates of problem behavior and compliance (when relevant) decrease, as well as an increase in independent manding. However, these results were obtained after including modifications of FCT procedures for Child 1 (i.e., response blocking) and Child 3 (i.e., addition of an enriched break). Further, these results did not generalize in a sustained manner across participants. That is, the results often did not generalize at all (i.e., Child 2 and Child 3).

Further, even when the results of FCT initially generalized to the respective mother (i.e., Child 1), these effects deteriorated across sessions. This may be due to both problem behavior and manding resulting in access to

the functional reinforcer. This is important because it is not unrealistic to expect that parents will continue to reinforce problem behavior with their children, even after being taught to reinforce manding. Therefore, it is plausible that in typical contexts, parents may reinforce both manding and problem behavior with their children. However, doing so may result in the effects of FCT not maintaining or generalizing to the parents. Thus, parent training which both teaches them to implement the intervention with high fidelity, as well as verbal descriptions of the importance of high fidelity to treatment outcomes, is likely needed to maintain treatment effects across time. It would also be interesting to assess whether parents providing differential reinforcement for most of the time would increase generalized effects of FCT with parents.

It is also important to note that even though manding was still being reinforced by the mothers, manding did not maintain; rather, problem behavior appeared to re-emerge and replace manding when the children were in the presence of their mothers. This may, once more, speak to the strength of the history of reinforcement between the mother and child, as compared to the reinforcement history between arbitrary therapists and the child.

Following the implementation of a GT package with Child 1 and Child 3, we observed low rates of problem behavior and discriminated manding and discriminated compliance across therapists and settings. Once more, these effects were not sustained during generalization probes. For Child 3, no generalization was observed with his mother. For Child 1, generalization was initially observed, but eventually reverted to problem behavior.

Importantly, in all three cases, after demonstrating that a treatment was effective in the training context, we had to expose all three mother-child dyads to remediation before treatment effects were enjoyed in the most relevant contexts (i.e., in homes, when mothers were interacting with their children). This indicates that without direct therapy, the effects of FCT may not generalize to natural agents, possible due to the reinforcement histories with those persons. Further, each intervention validated in the treatment context needed to be modified before parent-implemented versions of it could produce desirable outcomes; thus, calling into question the ecological validity of demonstrations of effect which do not include evaluations of endogenous implementers in endogenous settings (Stokes & Baer, 1977).

Combined with the observation that initial baseline rates of problem behavior with the respective mothers were higher than rates with the research team, it is interesting that the results of FCT did not generalize in a sustained manner. It is interesting that problem behavior rates were higher with the mothers as compared to the research team across most contexts because his may be due to the strength and duration of the reinforcement

histories with the mothers as compared to arbitrary therapists. This indicates that it may be useful to implement FCT initially—in addition to in evaluations of generalization and maintenance—with non-arbitrary therapists to ensure accurate rates of problem behavior are observed. It is also possible that we observed high rates of problem behavior due to behavioral contrast. That is, due to multiple schedules being in play for the child, the child may engage in higher rates of problem behavior with the mothers. It is difficult, however, to determine if the results observed in the current study are the norm because, once more, few studies in the literature have evaluated whether generalized effects of FCT maintain over time (cf., Ghammaghami et al., 2016).

Further, although there are many ways to assess and measure generalization of treatment effects, few studies have measured it in contexts in which therapy has never been conducted, when therapeutic contingencies are not strictly enforced (a scenario that we argue is representative of what children with challenging behavior are likely to experience in typical contexts). Given our results, we suggest future researchers extend our study through parametric analysis to explore the degree, and the circumstances under which, generalization of treatment outcomes for challenging behavior are most likely. For example, without intentional programming which involves endogenous implementers in the intervention process, our results suggest that the benefits of therapy conducted by external agents are unlikely to generalize. By contrast, teaching parents to implement therapy themselves, and formally incorporating them into the intervention process, appears to yield substantially more benefit for them (cf., Figures 9, 10, & 11). However, even these demonstrations are constrained by formal measurement systems under fairly contrived circumstances which make it difficult to predict the degree to which treatment effects would generalize to less structured circumstances (i.e., across the day and in the absence of external agents). Thus, we argue that there is much that we still don't understand about the generality and utility of treatment effects established during formal therapy. Currently, procedural and terminological inconsistencies associated the generalization literature make it difficult to derive meaningful answers from the existing research base (cf. Standish et el., in preparation).

4.2 Limitations

While the results of the current study have the merit needed to add to the vast knowledge base concerning both FCT and generalization, the study itself was not without limitations. First and foremost, we had to make adaptations to FCT along the way for each participant. While this aligns well with the underlying principles of evidence-base practice (i.e., utilizing clinical judgement in combination with the best available research and client

values; Levant & Hasan, 2008), it limits the confidence with which we can state that any specific procedure employed was responsible for the resultant impact on child behavior. Additionally, we thought it best to not include GT for Child 2 for several reasons—for example, due to his limited communication skills, we thought it best to not place his newly learned communication on extinction and thus risk losing his only communicative method learned thus far—however, this once more limits what can be said across tiers in terms of the effects of EO tolerance and generalization.

4.3 Future Directions

In summary, we found that our use of a GT package implemented solely by external agents was minimally successful at promoting generalized outcomes relevant to each child's mother (and brother when applicable), despite compelling evidence of its impact in the training context. Therefore, we believe that future studies should evaluate whether the inclusion of additional techniques used to promote generalization (e.g., training sufficient response exemplars, programming common social stimuli, etc.) may increase generalized effects of FCT to natural implementers in natural settings when instructional opportunities are not made available during evaluations of generalization.

It would also be interesting to evaluate the effects of a GT package in which initial FCT sessions are conducted in a more sterile setting (e.g., a clinic space) and GP sessions are evaluated in the natural setting (e.g., home, school). Further, it would be of value to evaluate the relationship between school and home in terms of whether the effects of FCT generalize if FCT is initially conducted by a natural implementer in a natural setting. It also would be worthwhile to evaluate whether the inclusion of natural implementers in the GT package phase would result in more generalized effects of FCT to other natural implementers. Lastly, it would be interesting to see if these results are also found to occur when the intensity and/or magnitude of the problem behaviors are less dangerous than the ones addressed in the current study.

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Appendix A

Open-Ended Functional Assessment Interview Date of Interview: _____

Developed by Gregory P. Hanley, Ph.D., BCBA-D

(Developed August, 2002; Revised: August, 2009)

Child/Client: _____ Respondent: _____
Respondent's relation to child/client: _____ Interviewer: _____

RELEVANT BACKGROUND INFORMATION
1. His/her date of birth and current age: ____-_____-_____ ____yrs ____mos Male/Female
2. Describe his/her language abilities.
3. Describe his/her play skills and preferred toys or leisure activities.
4. What else does he/she prefer?
QUESTIONS TO INFORM THE DESIGN OF A FUNCTIONAL ANALYSIS
To develop objective definitions of observable problem behaviors:
5. What are the problem behaviors? What do they look like?
To determine which problem behavior(s) will be targeted in the functional analysis:
6. What is the single-most concerning problem behavior?
7. What are the top 3 most concerning problem behaviors? Are there other behaviors of concern?
To determine the precautions required when conducting the functional analysis:
8. Describe the range of intensities of the problem behaviors and the extent to which he/she or others may be hurt or injured from the problem behavior.
To assist in identifying precursors to dangerous problem behaviors that may be targeted in the functional analysis instead of more dangerous problem behaviors:
9. Do the different types of problem behavior tend to occur in bursts or clusters and/or does any type of problem behavior typically precede another type of problem behavior (e.g., yells preceding hits)?
To determine the antecedent conditions that may be incorporated into the functional analysis test conditions:
10. Under what conditions or situations are the problem behaviors most likely to occur?
11. Do the problem behaviors reliably occur during any particular activities?
12. What seems to trigger the problem behavior?
13. Does problem behavior occur when you break routines or interrupt activities? If so, describe.
14. Does the problem behavior occur when it appears that he/she won't get his/her way? If so, describe the things that the child often attempts to control.
To determine the test condition(s) that should be conducted and the specific type(s) of consequences that may be incorporated into the test condition(s):
15. How do you and others react or respond to the problem behavior?
16. What do you and others do to calm him/her down once he/she engaged in the problem behavior?
17. What do you and others do to distract him/her from engaging in the problem behavior?
In addition to the above information, to assist in developing a hunch as to why problem behavior is occurring and to assist in determining the test condition(s) to be conducted:
18. What do you think he/she is trying to communicate with his/her problem behavior, if anything?
19. Do you think this problem behavior is a form of self stimulation? If so, what gives you that impression?
20. Why do you think he/she is engaging in the problem behavior?