An Evaluation of Multiple Dependent Variables across Distinct Classes of Antecedent Stimuli Pre and Post Functional Communication Training

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Abstract

Functional analyses of problem behavior for 4 young boys with developmental delays showed that problem behaviors were maintained by both negative and positive reinforcement. Functional communication training was conducted with one set of training stimuli in which the child's mother presented a work task in the family living room. Pretreatment probes were conducted with up to 10 sets of generalization stimuli that varied across tasks, settings, and people. Post treatment probes were conducted across the same generalization stimulus sets. Results for four dependent variables (problem behavior, task completion, manding, and social interactions) indicated that (a) problem behavior occurred across some but not all generalization stimulus sets during pretreatment; (b) following training, reductions of 90% or greater were observed within the context of the training stimuli; (c) reductions in problem behavior were observed for 70% of the post treatment generalization stimulus sets, but the reductions were not as large (M = 61%) as those observed with the training stimuli; and (d) the most consistent change observed during post treatment probes of generalization stimulus sets was increased task completion. Parents of all participants completed a behavior rating form and reported reductions in problem behavior across activities.

Keywords: stimulus generalization, FCT, response generalization, developmental disabilities, severe problem behavior.

Functional communication training (FCT) has been an effective procedure for reducing the occurrence of problem behavior and increasing appropriate communicative responses for people who engage in destructive behaviors that are maintained by social stimuli, such as gaining attention, gaining access to preferred items, or escaping task demands (e.g., Brown et al., 2000; Carr & Durand, 1985; Fisher, Kuhn, & Thompson, 1998; Hanley, Iwata, & Thompson, 2001; Wacker et al., 1998). To date, the majority of research on FCT has focused on the effects of treatment within a specific training context, and the evaluations have been limited to the short-term effects of FCT on the occurrence of problem behavior and appropriate communication. To further evaluate FCT, analyses are needed on both stimulus generalization (e.g., responding across untrained antecedent stimuli such as persons, tasks, and settings) and changes in other positive social responses, such task completion and social interactions, following the completion of FCT.

A few studies have evaluated the effects of FCT on behavior beyond the training context (Durand & Carr, 1991, 1992; and Durand, 1999). Durand and Carr (1991) demonstrated that reductions in problem behavior and increases in appropriate communication were maintained across untrained contexts (classroom settings, novel care providers) following FCT for 3 boys whose problem behavior was maintained by escape from academic demands. The reductions in problem behavior were maintained across non-trained stimuli over a 2-year period for 2 of the 3 participants without additional training. Similarly, Durand (1999) taught students with severe disabilities to use augmentative communication devices in their classroom to request stimuli that had been identified as maintaining problem behavior. In each case, FCT resulted in increased use of the communication device and a reduction in problem

behavior in the classroom. Furthermore, use of the device increased and problem behavior decreased in community settings following the completion of FCT.

Derby et al. (1997) evaluated the effects of FCT across multiple dependent variables including problem behavior, manding, toy play, and positive social behaviors with 4 young children over a 2-year period. Derby et al. demonstrated that the effects of FCT were not limited to problem behavior and manding, which were consequated directly within the FCT package. The results showed that gains in toy play and positive social behaviors occurred and were maintained for the 2-year period. Although the authors provided anecdotal information indicating that stimulus generalization occurred, documentation of pretreatment and post treatment performance across non-trained stimuli was not provided.

The purpose of this investigation was to further evaluate the effects of FCT across antecedent stimuli and responses. Three antecedent stimulus dimensions (tasks, settings, and persons) and four dependent variables (problem behavior, independent manding, task completion, and social interactions) were evaluated prior to and following the completion of FCT with 4 young boys whose problem behavior was maintained, at least in part, by escape from demands. Our approach was similar to that used by Shore, Iwata, Lerman, and Shirley (1994) and Asmus et al. (1999). In these studies, participants whose problem behavior was maintained by escape from demands were exposed to a series of pretreatment probes in which task demands were presented within sets of stimuli that varied along the dimensions of task, therapist, and setting. In the current study, the participants were observed within the context of a set of training stimuli (i.e., the mother presented a task in the family living room) and 9 or 10 (Brent only) sets of generalization stimuli that varied across tasks, settings, and persons.

The training and generalization stimuli for the current study were selected based on parents' reports of situations in which problem behavior was likely to occur. Training was conducted only within the context of the designated set of training stimuli. The four dependent variables were selected because they represented alternative methods for obtaining reinforcers. For example, engaging in appropriate social interactions with a parent can be an effective way to delay or briefly terminate the presentation of task demands while maintaining access to positive social reinforcers. Similarly, completing a work task also results in the termination of task demands and presumably the opportunity to gain access to preferred toys or adult attention. We conducted the pre and post treatment probes across training and generalization sets of stimuli to determine (a) the extent to which problem behavior occurred across distinct stimulus conditions prior to treatment, (b) the extent to which adaptive behaviors (task completion, independent manding, and social interactions) occurred across those same stimulus conditions, and (c) the changes in these four behaviors following the completion of FCT with the set of training stimuli. In addition, if a reduction in problem behavior did not occur within a set of generalization stimuli following the completion of FCT with the initial training stimuli, additional training was conducted to determine whether a reduction in training trials occurred when compared to the first training set of stimuli.

Method

Participants and Settings

Participants were the first 4 children referred to a federally funded research project (Wacker, Berg, & Harding, 1996) whose behavior was maintained, at least in part, by negative reinforcement. Each child was diagnosed with developmental delays and was referred to the project for exhibiting severe problem behaviors, such as self-injury and aggression, in their home settings.

Calvin was 5 years old and was referred to the project for problem behaviors that included aggression (hitting, kicking), property destruction, and noncompliance. Calvin used single words, but relied primarily on non-vocal communication (e.g., pointing to objects). Brent, age 4 years, was referred

to the project for aggression (pinching), property destruction, and noncompliance. Brent communicated using two- to three-word sentences. Theo was 4 years old and engaged in aggression (hitting, kicking, and biting), property destruction, and noncompliance. He communicated using complete sentences. Alex was 4 years old and was diagnosed with speech and language disorders and pervasive developmental delay. Problem behaviors for Alex included aggression (hitting, kicking, and biting) and noncompliance. Alex communicated by pointing or using single words. Calvin, Brent and Theo attended an early childhood special education program in their respective communities. Alex attended a university preschool program for speech and language development. Each child lived in his parent's home.

Each child's mother conducted all functional analysis and FCT sessions in the living room of the family's home with coaching by an experimenter. Pre and post treatment probes were conducted across different sets of antecedent stimuli for each child. The specific sets of stimuli were selected on an individual basis for each child and included different tasks, settings, and persons (see Table 1) as suggested by the parent.

Table 1. Stimulus Sets Across Phases and Participants

Child	Tasks		People		Settings	
	Training	Generalization	Training	Generalization	Training	Generalization
Calvin	Pick up blocks Brush teeth*	Pick up cars Brush teeth Directed play Directed play#	Mom Mom*	Therapist A Therapist C Teacher Therapist C#	Living room Bathroom*	Classroom A Classroom B Bedroom Bedroom#
Brent	Pick up blocks Point to pictures*	Pick up colors Point to pictures Brush teeth	Mom Mom*	Teacher Therapist A Therapist B Therapist C	Living room	Kitchen Grandmother's Classroom
Theo	Pick up blocks	Pick up colors Directed play (coloring) Meal	Mom	Therapist A Dad Teacher	Living room	Classroom A Classroom B Kitchen
Alex	Point to pictures	Coloring task Directed play (blocks) Meal	Mom	Therapist C Neighbor Dad	Living room	Bedroom Clinic A Clinic B

*= Phase 5, second functional communication training.
= Post treatment probe following Phase 5.

Response Definitions

All sessions were videotaped for subsequent data collection and analysis. A 6-s partial-interval recording system was used to measure three categories of child behavior. *Problem behavior* included self-injury, aggression, property destruction, crying, swearing, and screaming. *Social interactions* were defined as appropriate vocal and non-vocal exchanges between child and parent and included any verbal utterance (e.g., words, laughing) other than the target mand directed toward the adult, manual signing, touching the adult, and concurrent physical contact with an item with the adult. *Independent manding* was defined as an appropriate request for reinforcement without an adult's specific prompt to perform the mand. In cases in which the adult provided a vocal prompt at the beginning of a session (e.g., "Say, 'play'

if you want to play now"), the mand was scored as independent if it occurred at least 12 s after the prompt.

An additional measure of child behavior, *task completion*, was scored using an event-recording procedure. Adult task requests during each session were listed on a recording form. Task completion for each of the requests was then scored as either (a) task completed independently (no adult physical assistance), (b) task not completed, or (c) task completed with adult physical assistance. Task completion data were collected for all tasks except meals, and only independent task completion data are reported.

Interobserver Agreement

Trained data collectors independently scored all child behaviors from videotapes. Interobserver occurrence agreement for the partial-interval data was calculated based on exact interval-by-interval comparisons in which the number of occurrence agreements was divided by the number of agreements plus disagreements and multiplied by 100%. Interobserver agreement for child behavior was assessed for 47% of sessions across all children and ranged from 90% to 100% (M = 97%). For task completion data, interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement for task completion was assessed for 33% of sessions across children (range = 18% to 52% for each child) and ranged from 90% to 100% (M = 99%).

Experimental Design

The study was conducted in five phases (see Table 2). In Phase 1, a functional analysis using the methodology described by lwata et al. (1982/1994) was conducted in the child's home to identify social events maintaining problem behavior. A multielement design was used to evaluate child behavior across play, escape, tangible, and attention conditions. During Phase 2, baseline and pretreatment generalization stimuli probes were conducted for one set of training stimuli and across 9 or 10 (Brent only) sets of generalization stimuli for each child. During Phase 3, an FCT program using the training stimuli was developed for each child, and treatment probes were conducted on a weekly basis for up to 6 months. Baseline probes were repeated within an ABAB design for 3 participants. During Phase 4, additional probes were conducted across the sets of generalization stimuli following the completion of FCT with the original training stimuli. In Phase 5, a second FCT program was implemented if needed using a generalization stimulus set that was associated with problem behavior during the Phase 4 probes. Weekly treatment probes were conducted for up to 2 months. Additional probes to another set of generalization stimuli were conducted following the completion of the second FCT program for Calvin.

Table 2. Summary of Assessment and Treatment Procedures

Phase	Procedure	Purpose
1	Functional analysis	Identify reinforcers for problem behavior
2	Baseline and pretreatment generalization stimulus probes	Evaluate occurrence of problem behavior, task completion, manding, and social interactions across training and generalization stimulus sets (tasks, settings, and persons).
3	FCT	Train child to use appropriate mand to gain break to preferred activities following task completion with one stimulus set.
4	Post treatment generalization stimulus probes	Evaluate occurrence of problem behavior, task completion, manding, and social interactions across generalization stimulus sets
5	FCT 2	Train child to use appropriate mand to gain break to preferred activities following task completion with a second set of stimuli to evaluate reductions in number of training sessions.

Procedures

Descriptive information (scatter plot assessment, Touchette, MacDonald, & Langer, 1985; A-B-C assessment, Bijou, Peterson, & Ault, 1968) was obtained from parents prior to implementing the functional analysis. Parents also completed a behavior rating form, which was designed for this investigation, prior to the functional analysis and again following the completion of FCT. This form listed activities of daily living (e.g., dressing, meal times), activities that are typical for preschool-aged children (e.g., playing with siblings, asking for help appropriately), and community participation (e.g., going shopping or to a restaurant). Parents were asked to rate their child's behavior as (0) *Child never performs this activity*, (1) *Major behavior problems occur during this activity*, (2) *Minor behavior problems occur during this activity*, or (3) *No behavior problems occur during this activity*. Finally, parents were interviewed to clarify their responses and to develop hypotheses regarding events that may control their child's behavior. The descriptive information was used to select the antecedent stimuli for treatment and generalization probe conditions.

Phase 1: Functional Analysis

A preference assessment using the procedures described by Roane, Vollmer, Ringdahl, and Marcus (1998) was conducted concurrently with the functional analysis. The results of this assessment were used to select preferred and nonpreferred toys for assessment conditions. Data were collected on the percentage of 6-s intervals in which the child made physical contact with each toy. Toys that the children contacted for the highest percentage of intervals were selected as the preferred toys.

During the functional analysis (Iwata et al., 1982/1994), four assessment conditions were conducted to identify maintaining events for problem behavior. During the contingent attention condition,

the child had access to toys, but the parent ignored the child unless he engaged in problem behavior. Parents blocked any potentially destructive behavior and provided attention for about 20 s in the form of mild reprimands (e.g., "Don't do that. Go play with your toys."). During the contingent escape condition, parents provided task instructions with an age-appropriate activity (e.g., picking up blocks, pointing to pictures). Occurrences of problem behavior resulted in the removal of the task for about 20 s, and the child was allowed to play with other available toys in his own fashion. Task completion resulted in praise and presentation of the next request. During the contingent tangible condition, the child's play with a preferred toy was interrupted, and the child was presented with a toy that was identified as less preferred via the preference assessment. Occurrences of problem behavior resulted in the return of the original preferred toy to the child for about 20 s. During the play (control) condition, the child had access to preferred toys and continuous parent attention in the form of play and social interaction, minor disruptive behaviors were ignored, and potentially destructive behaviors were blocked. All assessment sessions lasted 5 min and were counterbalanced across conditions.

Phase 2: Baseline and Pretreatment Generalization Stimulus Probes

The purpose of baseline was to determine the levels of problem behavior, task completion, independent manding, and social interactions that occurred within the context of the training stimuli prior to implementation of FCT. The same task that was used during the escape condition of the functional analysis was used as the training task for baseline and treatment conditions. The training task for Calvin, Brent, and Theo consisted of picking up 30 blocks and placing them in a container. The training task for Alex involved pointing to 10 designated items in a book. Each boy's mother presented the training task to him in the family living room during each baseline session. The task was presented to the child until the task was completed or 5 min had elapsed. Problem behavior was on extinction and did not result in a break from the task demand; however, the child was not required to complete the task. The child was praised if he completed any portion of the task.

The purpose of the pretreatment probes was to evaluate the occurrence of the same behaviors across different tasks, settings, and persons. Pretreatment probes were conducted concurrently with baseline sessions. We varied only one stimulus dimension for each probe with two exceptions. Generalization to mealtimes was assessed using a different task (eating) in a different setting (kitchen), and tooth brushing also involved a different task (brushing) and a different setting (bathroom). The stimuli used for the generalization probes are listed in Table 1.

To assess generalization of behavior across settings, the child's mother presented the training task across three additional settings. To assess generalization of behavior across people, different adults presented the training task to the child in the child's living room. To assess generalization across tasks, the child's mother presented different task demands to the child in the home setting. These sessions were conducted in the family's living room with the exception of tooth brushing and eating a meal. Two to three pretreatment probes were conducted for each set of stimuli for each child using the same procedures that were used for the baseline sessions.

Phase 3: FCT and Baseline (Reversal) Probes

Parents were given verbal and written instructions on how to conduct FCT. Investigators also modeled the components of the training program and provided prescriptive feedback to the parents during weekly visits to the children's homes. Parents were instructed to conduct the training program on a daily basis for 10 to 20 min.

FCT probes. The FCT package included a demand-fading component to reduce the level of effort required to obtain an opportunity to mand appropriately and to provide multiple opportunities to mand

during each session. During the initial training sessions for Brent, Calvin, and Theo, the number of blocks each child was required to pick up was reduced from 30 blocks (baseline level) to 10 blocks. During training sessions, the child's mother presented the first set of 5 blocks and a container to the child and said, "Time to work. Pick up the blocks, please." If the child complied, the parent provided praise and prompted the child to mand appropriately for a break (e.g., "Good job. Do you want to do more work or play?"). If the child said, "Play," he received a 1-min break with preferred toys and parent attention. If the child said, "Work," another set of 5 blocks was set out. If the child did not say "play" following two parent prompts, then the child was instructed to pick up the next set of 5 blocks. If the child refused to follow parent instructions, hand-over-hand physical guidance (Brent and Theo) or escape extinction (Calvin) was implemented until compliance occurred. After a 90% reduction in problem behavior was observed for three consecutive sessions, the amount of work was increased to 30 blocks, and the child's mother presented sets of 10 blocks for the child to put in the container. The parents' prompts to mand were changed to a general question, "What would you like to do now?" The amount of work each child was required to complete before having an opportunity to mand for a "play" break was again increased after 4 to 5 months of FCT. At this point, all 3 children displayed no problem behavior and consistently complied with parent instructions. During these latter FCT sessions, the entire set of 30 blocks was presented at the beginning of each treatment session.

The target task for Alex was to point to specific pictures in a book as directed by his mother. During training sessions, Alex was given a card with a "work" symbol and was told, "Time to work." He was then instructed to point to 1 to 3 pictures (e.g., "Alex, point to the clock"). During Training Sessions 1 through 7, the number of pictures that Alex was asked to point to was reduced from baseline levels (10 pictures) to 5 pictures. If Alex complied, verbal praise was provided. If he refused to point to the picture after two requests or engaged in problem behavior, his mother used hand-over-hand guidance to direct his finger to the picture. After Alex completed one to three requests, a card with a "play" symbol was placed next to the "work" card and Alex was told, "Touch the play card if you'd like to play now." If Alex touched the "play" card, he received 1 min of play time with his mother and preferred toys. After 1 min, he was again handed the "work" card and directed back to work. If Alex refused to touch the "play" card or engaged in problem behavior, the "play" card was removed and his mother made additional requests for him to point to pictures. This procedure continued until five instructions had been completed.

After 2 months of FCT probes, the number of requests was increased to 10 (baseline level). At this point, Alex showed a consistent reduction in problem behavior and complied to parent instructions. Alex's mother also decreased the specificity of mand prompting by simply presenting the two picture cards and saying, "Do you want to do more work or play?" The sequence of "work" and "play" in this prompt was varied, as was the left and right positions of the cards, so that Alex had to discriminate between the two pictures.

Baseline (reversal) probes. The baseline condition was repeated for Brent, Calvin, and Theo after 2 weeks of treatment and was conducted in the same manner using the same antecedent stimuli (task, setting, and person) that were used in the functional analysis, baseline, and FCT sessions. Problem behavior and mands to escape the task demands were ignored, and the child was redirected to complete the training task during the return to baseline sessions. The baseline condition was not repeated for Alex.

Phase 4: Post treatment Stimulus Condition Probes

After a 90% reduction in problem behavior was observed for at least three consecutive sessions with the original training stimuli, two to four post treatment probes were conducted across generalization stimulus sets. Post treatment probes were conducted on all stimulus sets that resulted in problem behavior during the pretreatment probes and that were available at post treatment. The school building that Calvin, Brent, and Theo attended was not available at post treatment. Post treatment probes were also conducted

for one set of stimuli that did not occasion problem behavior during pretreatment (except for Calvin) to evaluate the occurrence of adaptive behaviors not displayed at baseline.

Post treatment probes were conducted using the same procedures that were used for the pretreatment probes for each generalization stimulus set. Although the children were not prompted to mand appropriately during the post treatment probes, occurrences of appropriate manding were reinforced.

Phase 5: Second FCT Program

A second FCT program was implemented for 2 of the participants, Calvin and Brent, who displayed problem behavior during the post treatment generalization probes. The children's parents selected which of the stimulus conditions would be included in the second training program. Training continued until a 90% reduction in problem behavior was observed for at least three consecutive sessions with the second set of training stimuli.

For Calvin, the second set of training stimuli was brushing his teeth in the family bathroom with his mother. Calvin was required to brush one area of his mouth and was then prompted to say "play" if he wanted to take a break from tooth brushing. He was then given a 1-min break before returning to tooth brushing. If Calvin refused to brush his teeth or engaged in problem behavior, he was denied access to toys and no parent attention was provided until he returned to tooth brushing. Following the completion of training, an additional set of post treatment probes was conducted with a generalization therapist (Therapist C) presenting a generalization task (directed play) in a generalization setting (bedroom).

For Brent, the second set of training stimuli was identifying letters or numbers during an educational game. Brent was instructed to point to letters or numbers that his mother identified (e.g., "Point to the letter H"). If Brent pointed to the letter, he received praise. After completing three requests, Brent was asked if he wanted to “work or play." If he said "play," he received a 1-min break. If he said "work," another series of instructions was given. If Brent refused to follow instructions or engaged in problem behavior, his mother used hand-over-hand physical guidance to help him complete the task.

Results

Functional Analysis

Results of the functional analyses (see Figure 1) indicated that problem behavior was maintained by both positive and negative reinforcement for each participant. Alex and Calvin demonstrated similar patterns of behavior. Alex engaged in problem behavior for a mean of 16% of the intervals and Calvin for 17% of the intervals when problem behavior resulted in escape from task demands. Both boys engaged in problem behavior for a mean of 14% of the intervals when problem behavior resulted in access to tangibles, and neither engaged in problem behavior during the play or contingent attention conditions.

Brent and Theo engaged in problem behavior in each of the test conditions but rarely during play. Brent engaged in problem behavior for 20% of the intervals during both the escape and the attention conditions. However, problem behavior decreased across sessions of the contingent attention condition from a high of 54% for the first session to 6% for the final session. Problem behavior was observed for a mean of 34% of the intervals during the tangible condition. Theo engaged in problem behavior for a mean of 30% and 27% of the intervals for the escape and tangible conditions, respectively. He engaged in problem behavior for a mean of 10% of the intervals during the attention condition.

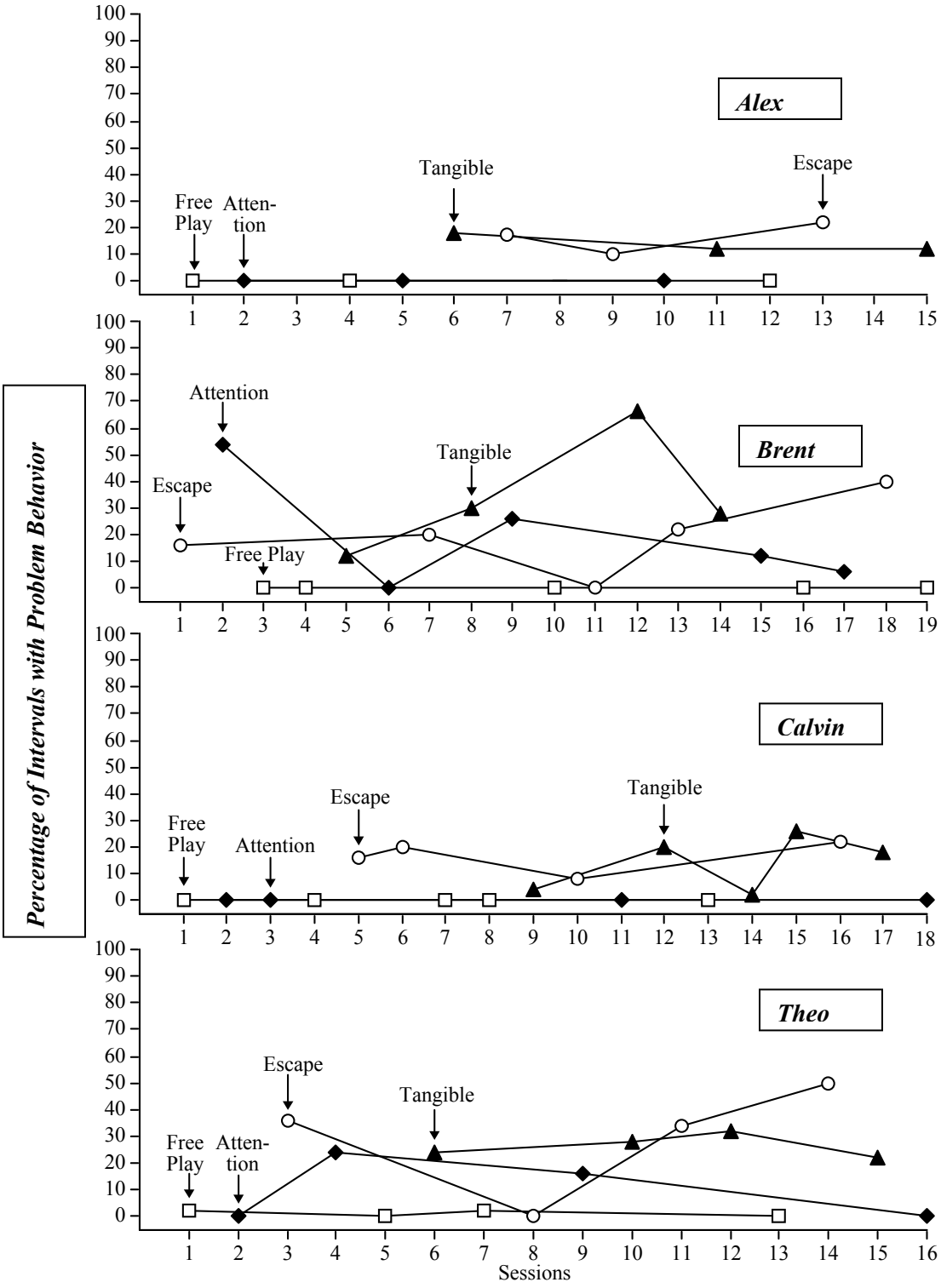

Figure 1. *Percentage of intervals with problem behavior during functional analyses for Alex (top panel), Brent (second panel), Calvin (third panel), and Theo (bottom panel).*

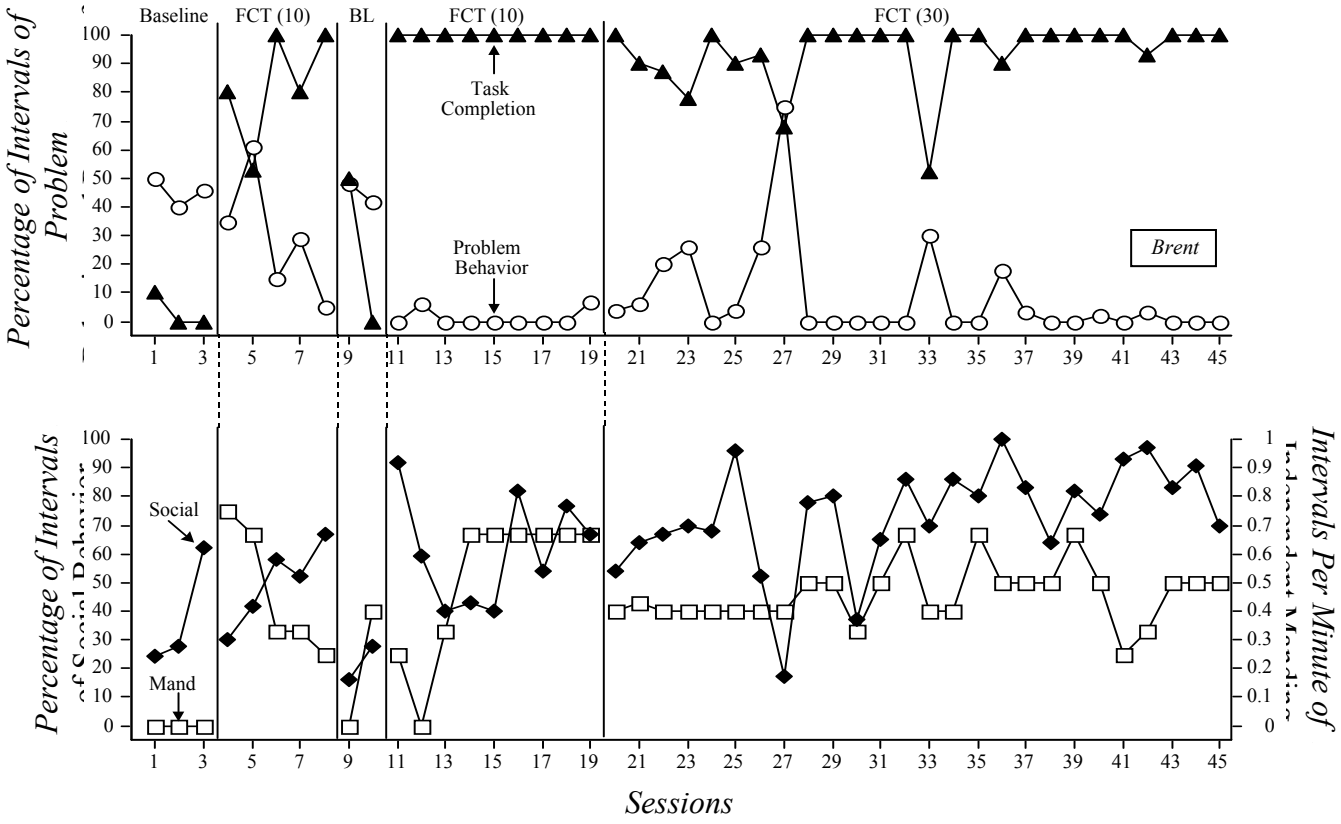

Figure 2. Percentage of intervals with problem behavior and percentage of task requests completed independently (top panel) and percentage of intervals with social interactions and intervals per minute of independent manding (bottom panel) for Brent. (FCT 10) = Functional Communication Training with 10 blocks, FCT (30) = Functional Communication Training with 30 blocks.

Baseline and Treatment with the Training Stimuli

The results of the treatment analysis for Brent, Calvin, Theo, and Alex are shown in Figures 2, 3, 4, and 5 respectively. As shown in Figure 2 (top panel), Brent engaged in problem behavior for a mean of 45% of the intervals (range, 40% to 50%) during the pretreatment baseline sessions. He completed 10% of the task requests for one session but did not complete any requests for the remaining baseline sessions. No mands (bottom panel) were observed during baseline, and social interactions occurred for a mean of 38% of the intervals. With the implementation of FCT, problem behavior decreased and task completion increased within the first five treatment sessions. Brent quickly learned the target mand, and social interactions continued at baseline levels. The baseline condition was repeated (Sessions 9 and 10), and problem behavior and task completion returned to pretreatment levels. No mands were observed for the first session, but mands were observed during the second session. Social interactions continued within the range observed during pretreatment and treatment. With the return of FCT, problem behavior decreased substantially and task completion remained high. Brent displayed the target mand at consistent levels across FCT sessions and social interactions increased.

Calvin engaged in problem behavior (top panel of Figure 3) for a mean of 58% of the intervals (range 34% to 78%) during the pretreatment baseline sessions. He completed 3% of the task requests for the initial baseline session and no requests for the remaining baseline sessions. Social interactions (bottom panel of Figure 3) occurred for a mean of 9% of the intervals and no mands were observed. Calvin's results for problem behavior and task completion were similar to Brent's results for the FCT and baseline reversal sessions. Increased levels of mands and social interactions were observed across FCT sessions. No mands and reduced levels of social interactions occurred during the baseline reversal sessions.

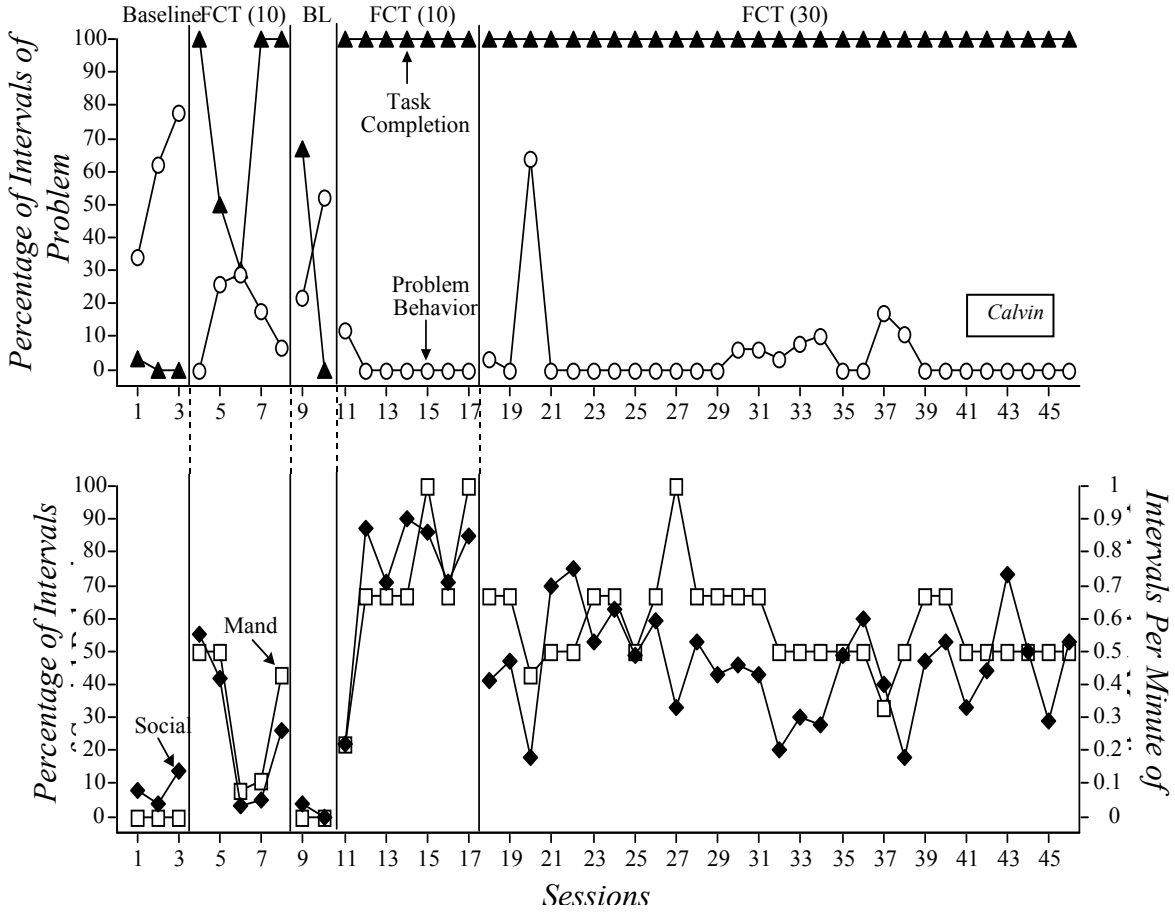

Figure 3. Percentage of intervals with problem behavior and percentage of task requests completed independently (top panel) and percentage of intervals with social interactions and intervals per minute of independent manding (bottom panel) for Calvin. (FCT 10) = Functional Communication Training with 10 blocks, FCT (30) = Functional Communication Training with 30 blocks.

Theo engaged in problem behavior (top panel of Figure 4) for a mean of 71% of the intervals (range, 68% to 76%) and 0% task completion occurred during the pretreatment baseline sessions. No mands (bottom panel of Figure 4) were observed, and he engaged in social interactions for a mean of 23% of the pretreatment baseline sessions. Similar to Brent and Calvin, problem behavior decreased substantially and task completion increased to 100% within the first five treatment sessions. Independent

mands and social interactions also increased during these sessions. The baseline condition was repeated for Sessions 10 and 11. Problem behavior, task completion, and social interactions remained at the same levels observed during FCT, however, manding decreased to 0 occurrences. Manding increased with the return of FCT, and problem behavior, task completion, and social interactions remained unchanged.

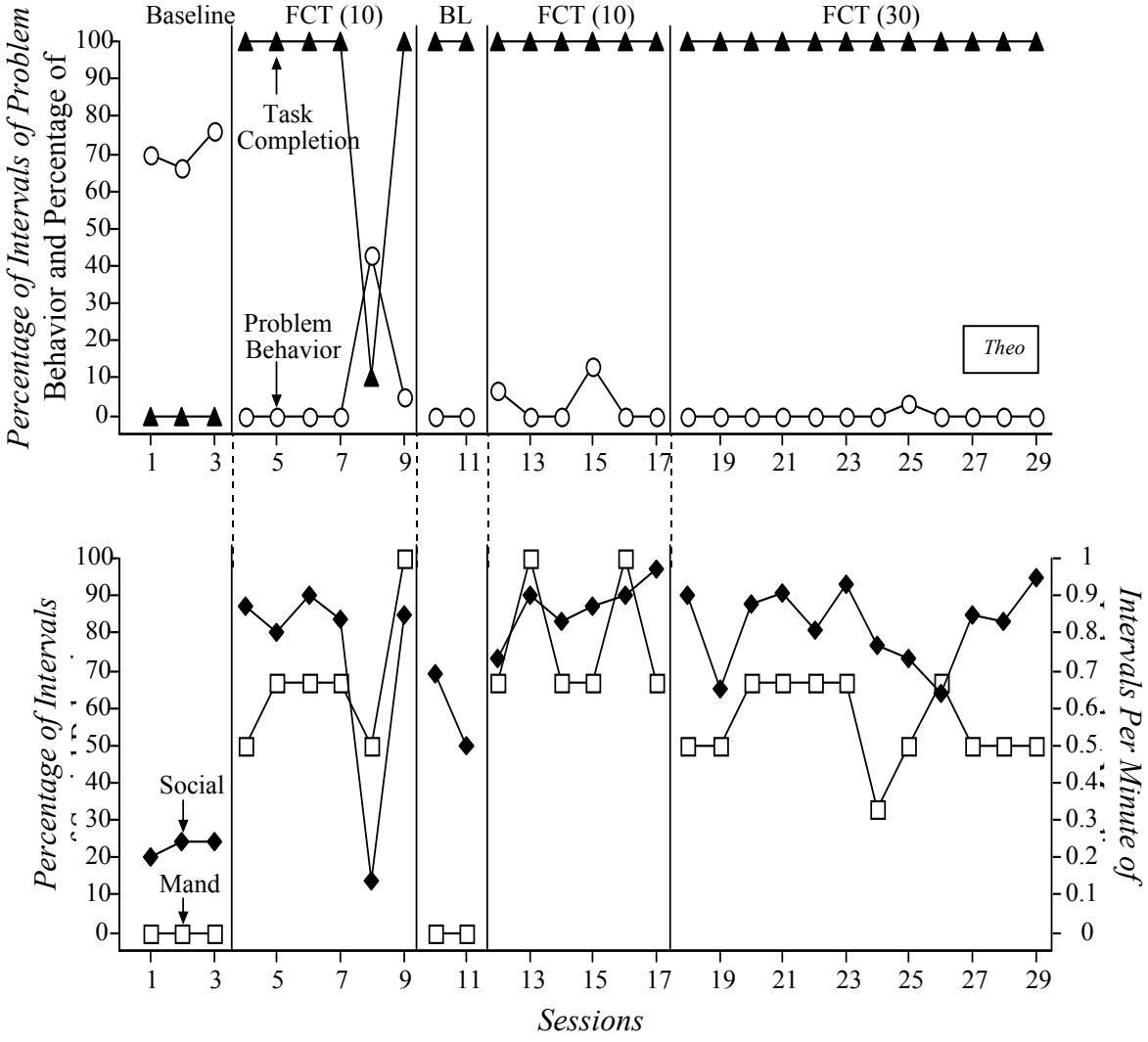

Figure 4. Percentage of intervals with problem behavior and percentage of task requests completed independently (top panel) and percentage of intervals with social interactions and intervals per minute of independent manding (bottom panel) for Theo. (FCT 10) = Functional Communication Training with 10 blocks, FCT (30) = Functional Communication Training with 30 blocks.

Alex engaged in problem behavior (top panel of Figure 5) for a mean of 26% percent of the intervals (range, 5% – 52%) across the pretreatment baseline sessions and completed a mean of 32% (range, 27% to 40%) of the task requests. Problem behavior decreased and task completion increased to 100% within the first five treatment sessions. When the task demand was increased from completing 5 requests to completing 10 requests, problem behavior became variable but remained below the baseline mean for all but two sessions. High levels of social interaction (M = 83%) occurred, and no mands were observed across the pretreatment baseline sessions (bottom panel of Figure 5). Mands increased and

remained fairly steady with the introduction of FCT, and social interactions continued to occur at levels similar to those observed during baseline. The baseline condition was not repeated with the training stimuli for Alex.

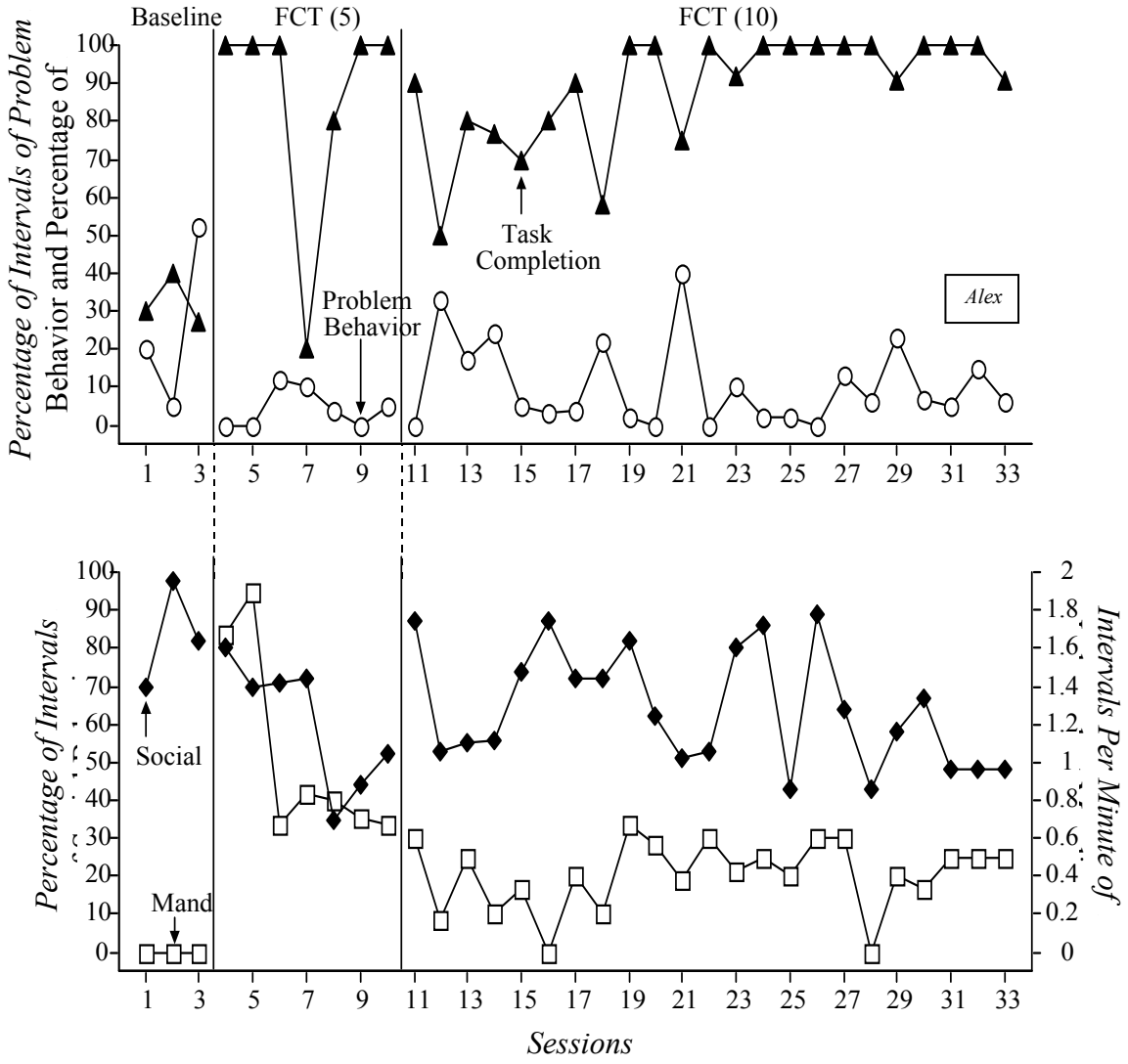

Figure 5. Percentage of intervals with problem behavior and percentage of task requests completed independently (top panel) and percentage of intervals with social interactions and intervals per minute of independent manding (bottom panel) for Alex.

In summary, treatment sessions occurred over a 3- to 6-month period (M = 4.5 months) for each participant. Problem behavior decreased substantially for each child. For the final three treatment sessions, Alex engaged in problem behavior for a mean of 8.6% of the intervals, and 0 occurrences of problem behavior were observed for the remaining participants. Task completion was 100% for Brent, Calvin, and Theo. Alex completed a mean of 97% of the task requests.

In contrast to their baseline performances, each participant also independently displayed the target mand "play" at or the near the maximum number of opportunities to mand (i.e., after completing a specified amount of the training task) for the final three treatment sessions. The percentage of intervals with positive social interactions increased from baseline to the end of training for Brent, Calvin, and Theo. For Alex, the percentage of intervals with social interactions decreased from a baseline mean of 83% of the intervals to a mean of 48% of the intervals, at least in part because he was working on the assigned task.

Pre and Post treatment Generalization Probes

Figures 6, 7, 8, and 9 show the mean performance for each participant for each generalization stimulus set for problem behavior (Figure 6), task completion (Figure 7), mands (Figure 8), and social interactions (Figure 9). A minimum of three sessions was conducted with each stimulus set (e.g., Alex's mother directed him to complete the training task in his bedroom for three sessions). The mean for each pretreatment generalization set is shown with the light shaded bar, and the mean for each post treatment generalization set is shown with the dark shaded bar. The results for generalization across tasks, settings, and persons are shown in the left, center, and right sections of each figure respectively.

Problem Behavior

Overall, lower levels of problem behavior (Figure 6) were observed during all of the pretreatment probes with the generalization stimuli than were observed during baseline with the set of training stimuli. All of the boys engaged in reduced levels of problem behavior when the mother presented different tasks in the home setting and when the mother presented the same task (training task) in different settings. Each of the boys performed the three sessions with one of the generalization sets with his mother with no occurrences of problem behavior. For 3 of the 4 participants, problem behavior either did not occur or occurred at very low levels for two different sets of generalization stimuli.

Alex displayed reduced levels of problem behavior for four of the eight post treatment generalization sets. The mean percentage of intervals with problem behavior remained roughly the same for the remaining generalization sets. Of the four generalization stimulus sets tested for Brent, reduced levels of problem behavior were observed for only one set (brushing teeth). Problem behavior remained unchanged for two sets and increased for one set (pointing to pictures). Training was provided then on the picture task. Following 10 treatment sessions, problem behavior decreased to a mean of 4%.

Calvin engaged in problem behavior for a mean of less than 3% of the intervals (range, 0% to 4%) for five of the six post treatment generalization sets. Problem behavior remained unchanged (M = 35%) in the remaining generalization set (brushing teeth). Training was provided for the tooth brushing task and problem behavior decreased to 0%. Two additional probes were conducted with Therapist C presenting a generalization task in a generalization setting and resulted in 0% problem behavior and 100% task completion. Theo's mean level of problem behavior was substantially reduced for each post treatment generalization set, except for eating a meal, which remained unchanged from pretreatment (0% problem behavior). No problem behavior was observed for three of the generalization sets.

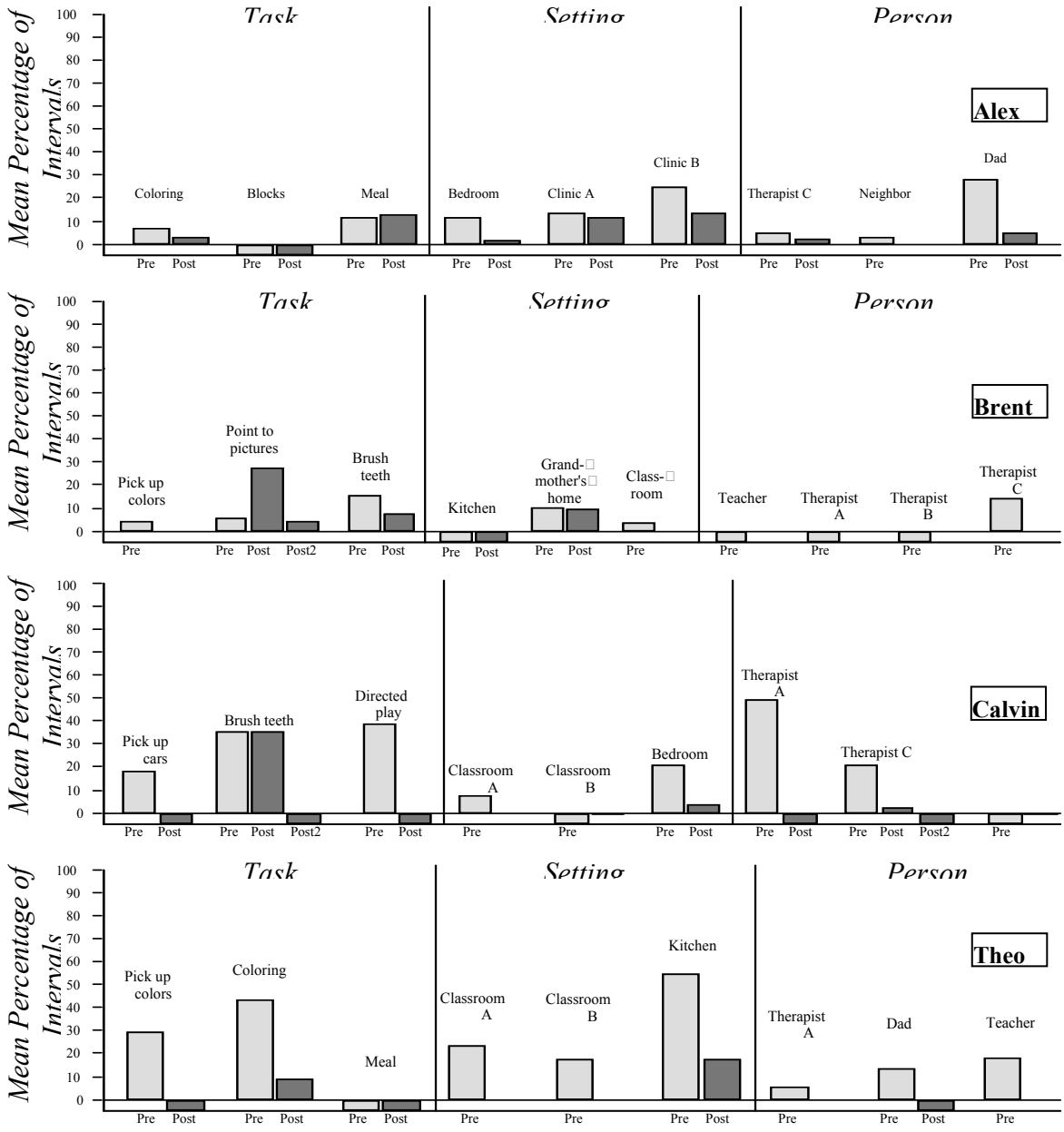

Figure 6. Mean percentage of intervals with problem behavior for pre and post treatment probes with generalization stimuli for Alex (top panel), Brent, (second panel), Calvin (third panel), and Theo (bottom panel).

Task Completion

Task completion never exceeded 10% for Brent, Calvin, and Theo, and never exceeded 50% for Alex during the pretreatment baseline sessions conducted with the set of training stimuli. However, a mean of 95% to 100% task completion (Figure 7) was observed for 13 of the 37 generalization stimulus sets during the pretreatment probes. At post treatment, a mean of 95% to 100% task completion occurred

for 15 of the 21 stimulus sets probed. Furthermore, only 3 stimulus sets resulted in 50% or less task completion. Alex displayed increased task completion for six of his seven post treatment generalization sets. Brent completed 100% of the task requests for two of the stimulus sets during pretreatment and post treatment. For the remaining two stimulus sets, task completion increased for one task (brushing teeth) and decreased for the remaining task (pointing to pictures). Following the completion of training for the picture task, Brent completed the task with a mean of 93% task completion.

Calvin completed 100% of the task demands presented for three of the post-treatment generalization stimulus sets and completed a mean of 84% of the demands for a fourth set. Task completion for brushing teeth ranged from 1% to 100% (M = 50%) and task completion for Therapist C averaged 19% during pretreatment. Following training on the tooth-brushing task, task completion increased to 100%. During the two additional probes conducted with Therapist C, 100% task completion occurred. Theo completed 100% of the task demands for picking up colors and the training task with his father. Task completion was 100% for the final two probes conducted with each of the remaining generalization sets.

Fig. 7. Next Page

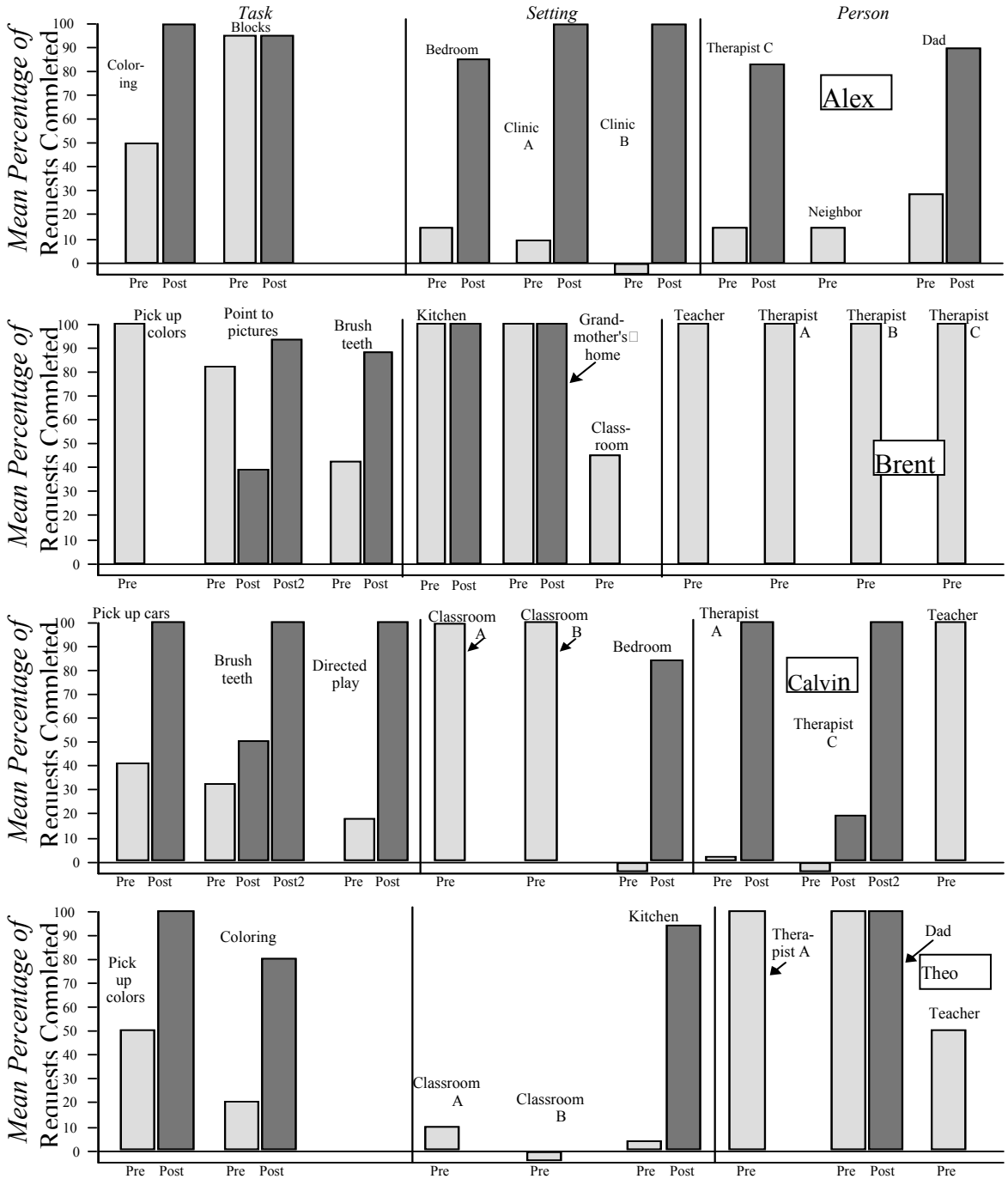

Figure 7. Mean percentage of task requests completed across pre and post treatment probes with generalization stimuli for Alex (top panel), Brent, (second panel), Calvin (third panel), and Theo (bottom panel).

Independent Mands

Independent appropriate manding never occurred during the baseline sessions with the set of training stimuli, but appropriate manding (Figure 8) was observed for seven of the pretreatment probe conditions. Manding did not increase from pre to post treatment for the majority of generalization probes for any participant. Only one instance of manding was observed across the eight post treatment generalization sets for Alex. Manding was not observed during the first set of post treatment probes for Brent, but manding occurred during the second set of post treatment probes for the point to pictures task following FCT on that task. Calvin engaged in appropriate manding for one generalization across setting stimulus set (bedroom). Appropriate mands were not observed during the remaining six post treatment probe conditions. Following training, appropriate mands occurred for a mean of .5 intervals per minute for the second training task (tooth brushing), but no appropriate mands occurred during the subsequent generalization across persons probes (Therapist C). Theo demonstrated an increase in appropriate manding for two of the five post treatment sets.

Figure 8, Next Page

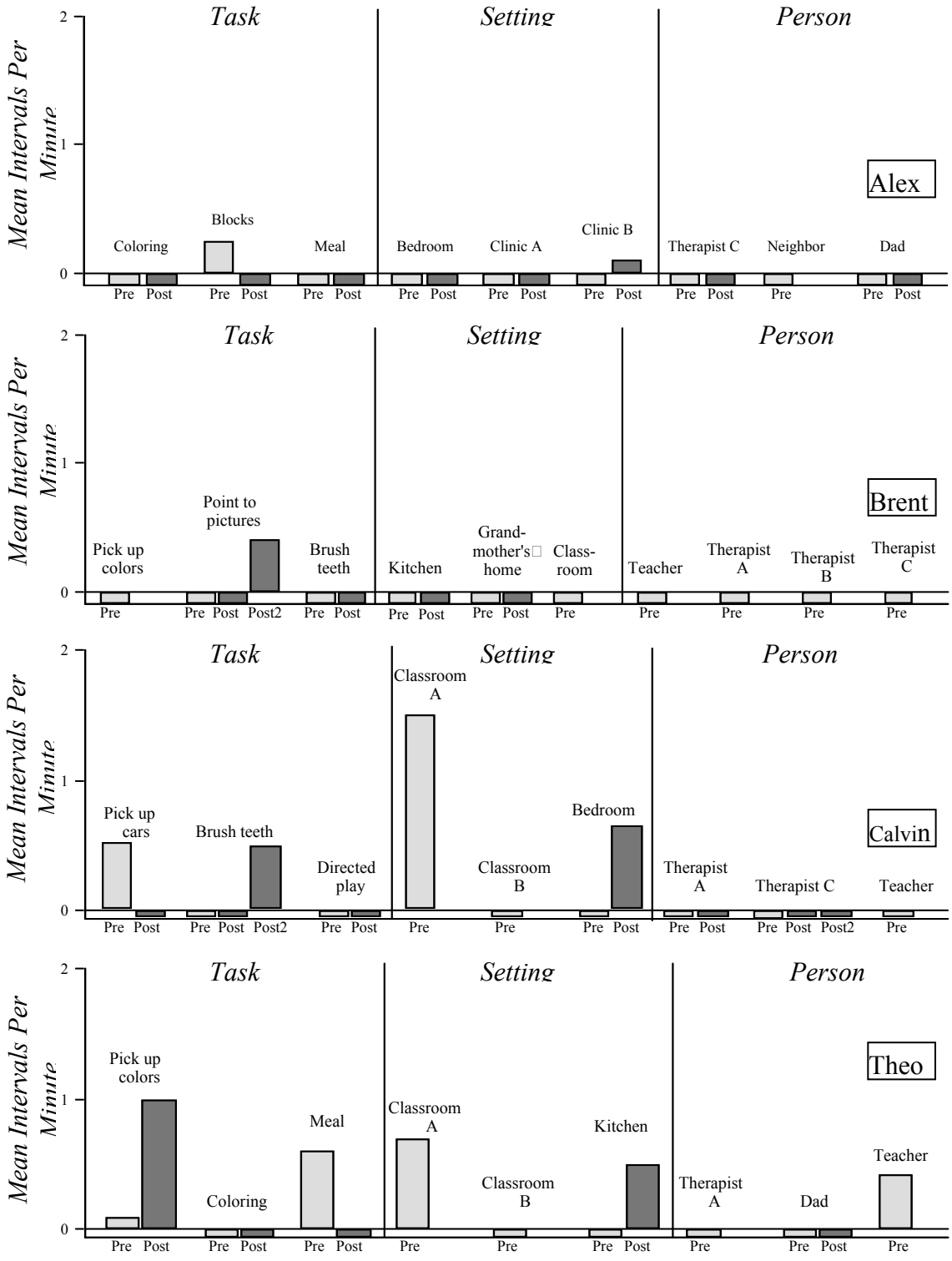

Figure 8. Mean intervals per minute of manding across pre and post treatment probes with generalization stimuli for Alex (top panel), Brent, (second panel), Calvin (third panel), and Theo (bottom panel).

Social Interactions

Social interaction data are presented in Figure 9. Similar levels of social interactions were observed across the baseline and pretreatment generalization probe sessions for 3 participants. However, Theo engaged in lower levels of social interactions during the pretreatment generalization probes than were observed for the baseline sessions. The percentage of intervals with social interactions during pretreatment ranged from an average of 14% to 94% of the intervals for Alex, 8% to 100% of the intervals for Brent, 0 to 56% for Calvin, and 8% to 74% for Theo.

Positive social interactions increased for the majority of post treatment sessions for each participant. Brent demonstrated an increase in social interactions across each of the post treatment generalization sets. Alex engaged in increased levels of social interactions in four of eight post treatment sets. Positive social interactions remained relatively unchanged for three of the remaining generalization sets and decreased for one set (generalization across tasks – meal). Calvin demonstrated an increase in social interactions for three post treatment generalization sets. Pre and post treatment levels of behavior were unchanged for one set and decreased for one set (brushing teeth). Theo engaged in increased levels of social interactions for three of the five post treatment generalization sets, and behavior remained relatively unchanged for the remaining two post treatment sets.

Figure 9, Next Page

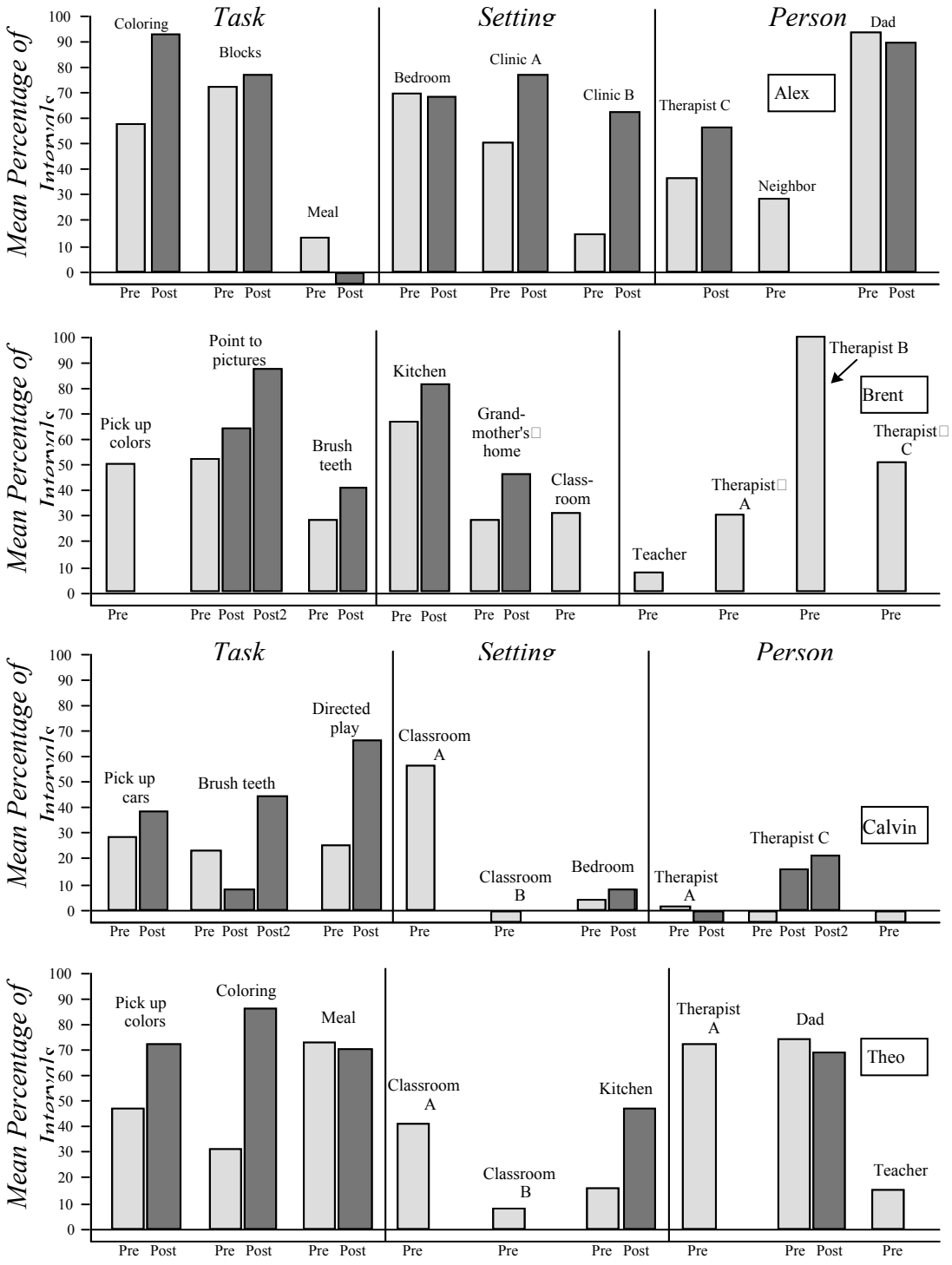

Figure 9. Mean percentage of intervals with positive social interactions across pre and post treatment probes with generalization stimuli for Alex (top panel), Brent, (second panel), Calvin (third panel), and Theo (bottom panel).

Summary

Each child met the criterion of 90% reduction in problem behavior with the training stimuli following FCT. Concurrent increases in appropriate manding and task completion were also observed. Across the 4 participants, 23 stimulus sets were probed at post treatment for generalization. Of the 20 stimulus sets in which problem behavior was observed at pretreatment and that were probed at post treatment, reductions in problem behavior were observed for 14 (70%) of the sets (see Figure 10, top panel). Reductions in problem behavior were observed for 67% of the generalization across tasks sets, 71% of the across settings sets, and 80% of the across persons sets.

Increases in task completion occurred for 14 (78%) of the 18 generalization stimulus sets in which task completion was less than 100% at pretreatment (second panel of Figure 10). Increased task completion occurred for 88% of the generalization across task sets and 100% of the generalization across settings and persons sets. Increased appropriate manding was observed for 4 (17%) of the 23 generalization stimulus sets probed at post treatment (third panel of Figure 10). Manding was observed for 9% of the across tasks sets, 43% of the across settings sets, and 0% of the across persons sets. Gains in social interactions were observed for 16 (70%) of the post treatment generalization sets (bottom panel of Figure 10). Increased social interactions were observed for 55% of the post treatment generalization across tasks sets, 71% of the generalization across settings sets, and 40% of the generalization across persons sets.

Figure 10, Next Page

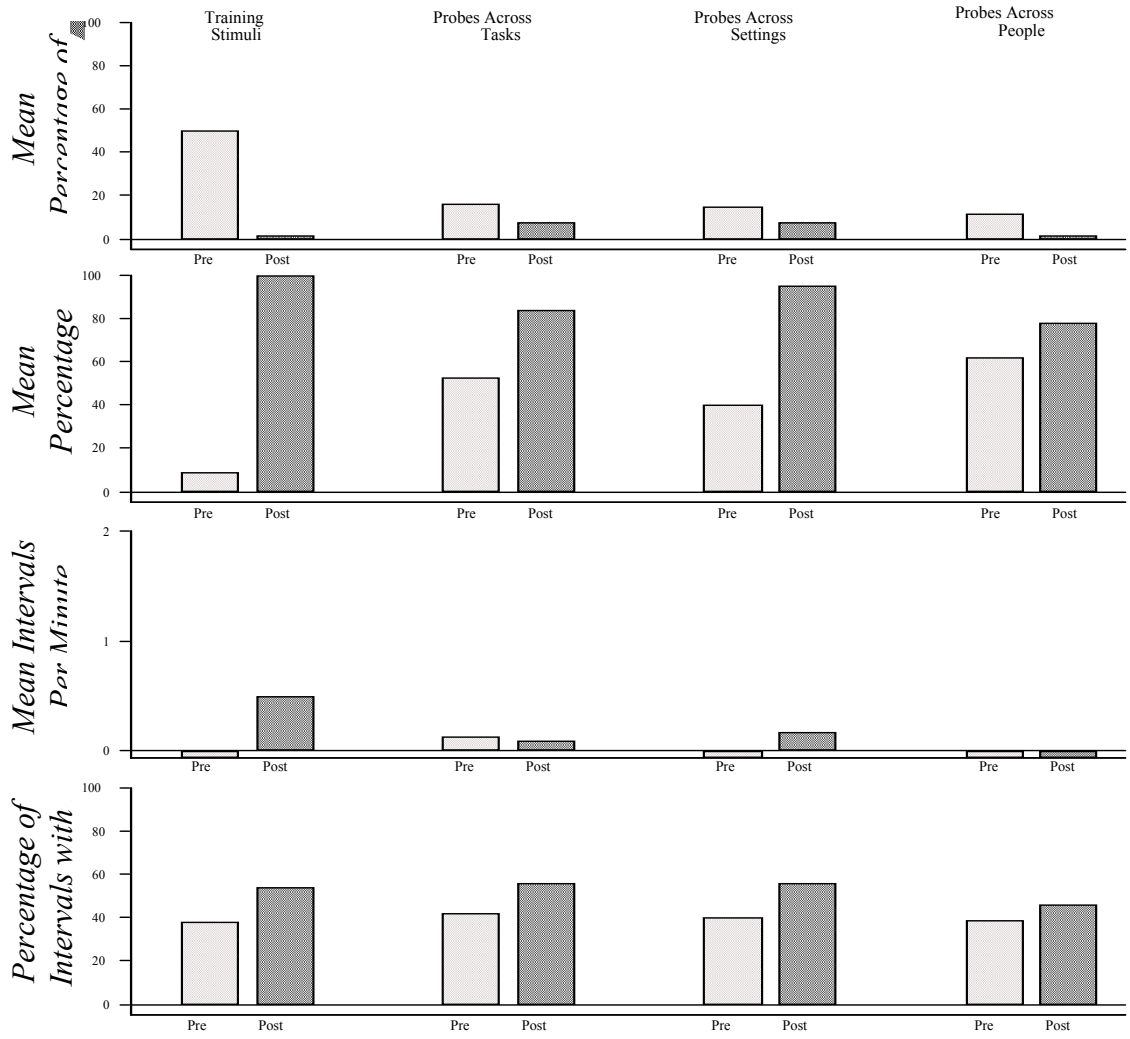

Figure 10. Mean percentage of intervals with problem behavior (top panel), mean percentage of task requests completed (second panel), mean intervals per minute of independent manding (third panel), and mean percentage of intervals with social interactions for pre and post treatment measures of training stimuli, generalization probes across tasks, generalization probes across settings, and generalization probes across persons for all 4 participants.

Behavior Rating Form

The percentage of activities that the parent scored as resulting in major problem behaviors is shown in Figure 11. Prior to the initiation of FCT, Alex's parents reported that 48% of the activities listed on the behavior rating form resulted in major problem behaviors. This percentage decreased to 11% following the conclusion of training. The percentage of activities resulting in major problem behaviors for Brent decreased from 38% at pretreatment to 17% at post treatment. The biggest reductions in problem behaviors occurred for Calvin, with 40% of the activities resulting in major problem behaviors at pretreatment and no activities resulting in major problem behaviors at post treatment. However, one activity that was scored as resulting in major problem behaviors at pretreatment was no longer attempted at post treatment. Theo had the lowest percentage (30%) of activities scored as resulting in major problem behaviors at pretreatment. At post treatment, that number was reduced to 18%.

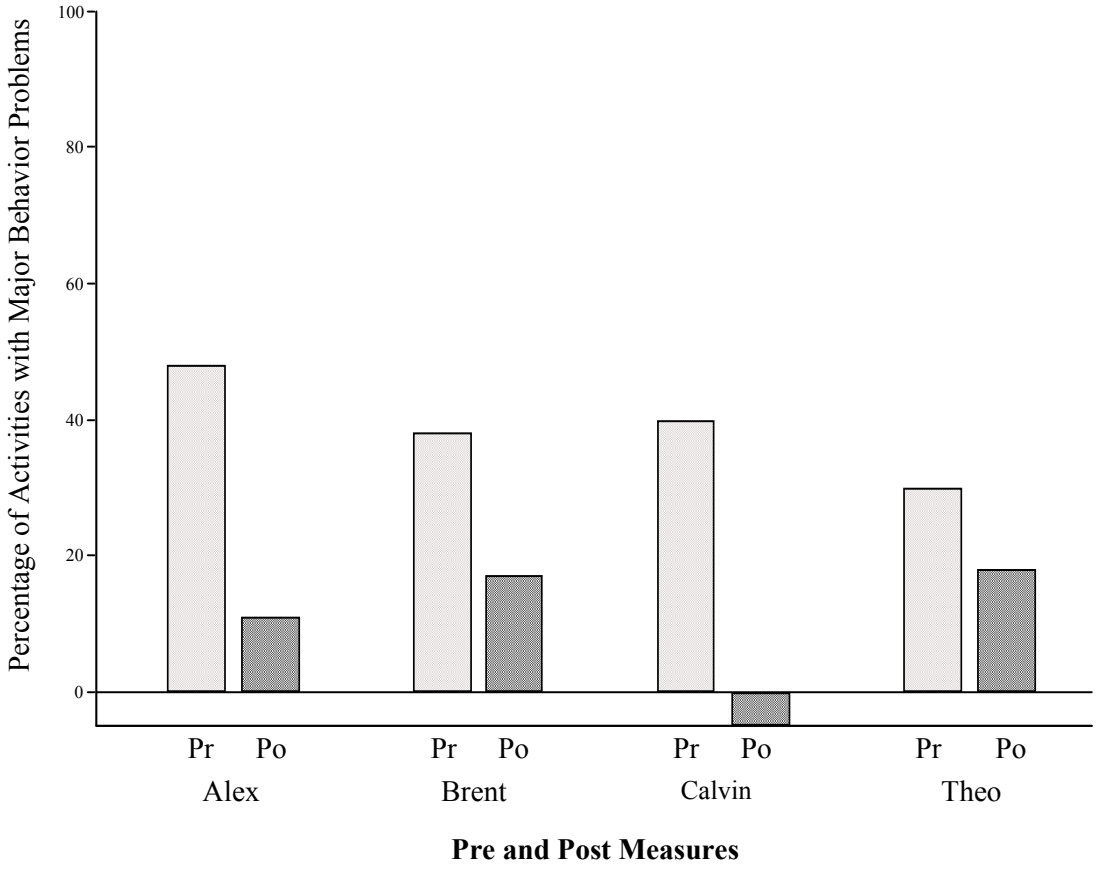

Figure 11. Percentage of activities with major problem behaviors based on parent scoring on the child behavior rating form prior to and following FCT for each participant.

Discussion

The results of this investigation showed that prior to FCT, (a) problem behavior was always observed within the context of the training stimuli, (b) problem behavior was observed across some but not all of the variations in antecedent stimuli, and (c) the occurrence of adaptive behaviors (mands, task completion, and social interactions) varied across changes in antecedent stimuli as well. Problem behavior was observed during every baseline session with the training stimuli set (target task presented by the mother in the living room). However, problem behavior was not observed for 8 of the 37

generalization stimulus sets probed during pretreatment, even though at least one, and typically two, of the training stimuli (task, setting, person) were included with each set. These results are important because they show the value of conducting pretreatment probes to assess the persistence of target behaviors across stimulus variations. In the current study, if the evaluation of the effects of FCT across generalization stimuli had been limited to probes conducted at post treatment, we may have assumed, incorrectly, that FCT resulted in reductions in problem behavior across almost all of the generalization stimulus sets, rather than recognizing that differences in responding occurred across stimulus variations prior to treatment.

Carr, Yarbrough, and Langdon (1997) demonstrated that, for some individuals, problem behavior may be under the stimulus control of a specific stimulus condition (such as the presence of an item) and that behavior may be observed only when that stimulus is present. The results of the pretreatment probes for the current study suggested that none of the stimuli contained within the training set always exerted stimulus control of problem behavior when presented separately from the remaining two training stimuli.

These results are similar to those reported by Shore et al. (1994) and Asmus et al. (1999) and show that the presentation of task demands in general did not always occasion problem behavior and that even presumably minor changes in the stimulus sets were sufficient to disrupt the response-reinforcer relationship. Additional research, such as that conducted by Halle and Holt (1991), is needed to examine the effects of changes in antecedent stimuli on the occurrence of problem behavior prior to treatment.

The idiosyncratic results achieved across pretreatment probes for Shore et al. (1994), Asmus et al. (1999), and the current study may be due to the individual's reinforcement history with specific stimuli. Some stimuli may be associated with reinforcement for problem behavior and other stimuli may be associated with reinforcement for adaptive behavior. Or, as shown by Asmus et al., the child may not have a reinforcement history with a particular item. This hypothesis may explain the pretreatment probe results for Calvin in the current study. Calvin engaged in problem behavior during each baseline session with the training stimuli; however, when his mother presented the same task in his classroom and his teacher presented the same task in his home, Calvin completed 100% of the task requests with no problem behavior. These results suggested that stimuli associated with Calvin's classroom or teacher may not have been paired with reinforcement for problem behavior and therefore functioned to disrupt the response-reinforcer relation that occurred in the presence of the remaining training stimuli.

Assessment of the three adaptive responses (i.e., task completion, independent mands, and social interactions) during the pretreatment probes of the current study showed that changes in the antecedent stimuli resulted in differences in the occurrence of these adaptive behaviors. Furthermore, there did not appear to be a direct relationship between the occurrences of problem behavior, task completion, appropriate manding, or social interactions during the pretreatment probes.

Following the implementation of FCT, consistent reductions in problem behavior and increased mands were observed across each participant in the context of treatment. When the contingencies for problem behavior and mands were removed (baseline probes) problem behavior, task completion, and mands returned to baseline levels, except for Theo, whose problem behavior and task completion remained at treatment levels and only manding was affected by the removal of the treatment package.

Following the completion of FCT, (a) the results for problem behavior across the generalization stimuli were mixed, with reductions in problem behavior occurring across most but not all stimulus sets; (b) manding typically did not occur within the context of the generalization stimuli; and (c) the most consistent change observed within the context of the generalization stimuli was increased task completion for all 4 participants.

Few investigations of FCT have reported task completion data for either the training or the generalization tasks. In the current study, the greatest change in behavior from pre to post treatment with the generalization stimuli sets occurred for task completion. The percentage of task requests completed during the post treatment generalization probes ranged from a mean of 78% during the probes across persons to a mean of 95% during the probes across settings (see Figure 7). In contrast to the current study, Shore et al. (1994) reported that only 2 of 5 participants complied with more than 50% of the task requests for the training task during the final training sessions, and none of the participants complied with more than 50% of the task requests during the initial generalization probes following training. Therefore, although the escape extinction procedure implemented by Shore et al. resulted in impressive reductions in problem behavior, these reductions were not associated with an increase in compliance to task requests.

Very little change was observed from pretreatment to post treatment probes for appropriate manding in the context of the generalization stimuli in the current study. The percentage of conditions with an increase in appropriate manding for the initial set of probes was 17%. This small increase in the occurrence of appropriate mands in the current study contrasts with the results of Durand (1999) and Durand and Carr (1991), who both reported gains in appropriate manding across generalization stimuli. Two differences in the way in which training was conducted may account for the differences observed in appropriate manding across untrained stimuli at post treatment. The first difference is that Durand (1999) and Durand and Carr (1991) used a multiple exemplars (Stokes & Baer, 1977) approach to training, which can be an effective procedure for promoting stimulus generalization. Both Durand and Carr (1991) and Durand (1999) incorporated multiple care providers and at least two training tasks within training. In the current study, training was conducted with one task, with only the child's mother, and in only one setting. Additional training was provided on a second task for 2 participants (Calvin and Brent) following the post treatment generalization probes. A substantial decrease in the number of training trials required to reach criterion was observed for both participants, and independent mands increased for the second training task. However, no additional mands were observed during generalization stimulus probes to another person for Calvin.

The second difference was the contingencies for reinforcement. In Durand (1999) and Durand and Carr (1991), the identified reinforcer was provided contingent on the target mand, regardless of the presence of other behaviors; engagement in the target mand was the only response required to gain reinforcement. In the current study, the participants were required to complete a two-step chain: finish a designated amount of work and then appropriately mand for reinforcement. Furthermore, reinforcement was withheld or removed if problem behavior was observed. Appropriate manding was the terminal response in a chain of responses required to obtain reinforcement. Compliance and task completion appear to have served as precurrent responses (Fisher, DeLeon, & Kuhn, 2000) that created an opportunity for appropriate manding to be reinforced; that is, completion of the task set the occasion for reinforcement of appropriate mands. As a result, it is not surprising that Durand (1999) and Carr and Durand (1991) observed greater increases in appropriate manding than were observed in the current study and that the participants in the current study demonstrated greater gains in task completion than in appropriate manding. It is of interest to note that although both responses (task completion and manding) were required during training in the current study, only the precurrent response (task completion) was typically observed during the post treatment generalization probes.

One limitation of the current study is the experimental design used to show changes in the four dependent variables within the context of the generalization stimuli following the completion of FCT with the training stimuli. The pre to post treatment comparisons were conducted within AB designs. Although the AB design does not establish experimental control, replication of the effects achieved for each dependent variable across all 4 participants suggests that the results were not due to chance.

Two or three pretreatment probes and post treatment probes were conducted across each stimulus set for each participant, and the mean for each set is displayed in Figures 6 through 9. In these probes, two stimulus dimensions matched the training set, whereas the third dimension varied. The pretreatment and post treatment probes for each stimulus dimension (i.e., task, person, and setting) could be conceptualized as multielement designs for each stimulus dimension. For example, the occurrence of problem behavior for the three baseline sessions with the training task for Alex could be plotted against the occurrence of problem behavior during the three pretreatment sessions in which his mother presented the coloring task in the living room, the three sessions in which she presented the block task in the living room, and the three meal sessions. The resulting figure would show that problem behavior occurred at consistently higher levels with the training task than with any of the generalization tasks. Similar figures could be constructed for each stimulus variation and each dependent variable for each participant for both the pretreatment and post treatment data sets.

The results of this study raise several questions for further investigation. In the current study, the effects of FCT were evaluated across four dependent variables. With the exception of Derby et al. (1997), previous research reported treatment outcomes for problem behavior and manding only. The impact of other treatment procedures (escape extinction without a DRA component or FCT without an additional response requirement) on adaptive behaviors, such as task completion and social interactions, could provide valuable information that would allow parents and other care providers to make informed choices between treatment options. Furthermore, few studies conducted on function-based treatments have assessed pre and post treatment performance on variations of the antecedent stimuli associated with the establishing operations for problem behavior. Assessments of problem behavior across variations in antecedent stimuli, similar to the pre and post treatment probes conducted by Shore et al. (1994) and the current, study may provide useful information regarding the generality of problem behavior and treatment gains associated with function-based treatments.

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