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EVALUATION OF MULTIPLE SCHEDULES WITH NATURALLY OCCURRING AND THERAPIST-ARRANGED DISCRIMINATIVE STIMULI FOLLOWING FUNCTIONAL COMMUNICATION TRAINING

Kenneth D. Shamlian,
UNIVERSITY OF NEBRASKA MEDICAL CENTER'S MUNROE-MEYER INSTITUTE

Wayne W. Fisher,
UNIVERSITY OF NEBRASKA MEDICAL CENTER'S MUNROE-MEYER INSTITUTE

Mark W. Steege,
UNIVERSITY OF SOUTHERN MAINE

Brenna M. Cavanaugh,
UNIVERSITY OF NEBRASKA MEDICAL CENTER'S MUNROE-MEYER INSTITUTE

Kristina Samour, and
NOVA SOUTHEASTERN UNIVERSITY

Angie C. Querim
UNIVERSITY OF NEBRASKA MEDICAL CENTER'S MUNROE-MEYER INSTITUTE

Abstract

Many studies have shown that (a) functional communication training (FCT) is effective for reducing problem behavior, and (b) multiple schedules can facilitate reinforcer schedule thinning during FCT. Most studies that have used multiple schedules with FCT have included therapist-arranged stimuli (e.g., colored cards) as the discriminative stimuli (S^Ds), but recently, researchers have evaluated similar multiple-schedule training procedures with naturally occurring S^Ds (e.g., overt therapist behavior). The purposes of the current study were to compare the effects of arranged and naturally occurring S^Ds directly during (a) acquisition of discriminated functional communication responses (FCRs) and (b) generalization of discriminated FCRs when we introduced the multiple schedules in novel contexts in which the naturally occurring stimuli were either relatively easy or difficult to discriminate. Results showed that (a) 2 of 3 participants acquired discriminated responding of the FCR more rapidly with arranged than with naturally occurring stimuli, (b) 2 of 3 participants showed resurgence of problem behavior, and (c) 2 of 3 participants showed greater generalization of discriminated responding to novel contexts with arranged stimuli than with naturally occurring stimuli. We discuss these results relative to the

Correspondence regarding this article should be addressed to Kenneth D. Shamlian, who is now at the Department of Pediatrics, School of Medicine and Dentistry, University of Rochester, 601 Elmwood Ave., Rochester, New York 14620, ; Email: kenneth_shamlian@urmc.rochester.edu

conditions under which naturally occurring and arranged S^Ds may promote rapid and generalized treatment gains.

Keywords

discriminative stimuli; functional communication training; generalization; multiple schedules; resurgence

Research has repeatedly demonstrated the effectiveness of functional communication training (FCT) as an intervention for replacing problem behavior with an alternative, prosocial communicative response to access the same functional reinforcer (e.g., Carr & Durand, 1985; Fisher, Kuhn, & Thompson, 1998; Fisher, Thompson, Hagopian, Bowman, & Krug, 2000; Hagopian, Contrucci Kuhn, Long, & Rush, 2005; Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998; Hanley, Iwata, & Thompson, 2001; Tiger & Hanley, 2004; Tiger, Hanley, & Heal, 2006). The effectiveness of FCT is dependent first on the correct identification of the function of the target problem behavior through a functional analysis (e.g., Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994) to determine how the behavior operates on the environment (e.g., via social negative reinforcement, social positive reinforcement, automatic reinforcement). Next, the individual is taught an alternative, functional communicative response (FCR) to replace the problem behavior (e.g., instead of hitting someone to gain attention, the individual exchanges a card for attention). The FCR is typically established using a dense schedule of reinforcement (e.g., fixed-ratio [FR] 1; Kelley, Lerman, & Van Camp, 2002) and then evaluated to demonstrate its effectiveness. Finally, schedule-thinning procedures are applied to make the intervention more practical (Betz, Fisher, Roane, Mintz, & Owen, 2013; Fisher, Greer, Fuhrman, & Querim, 2015; Greer, Fisher, Saini, Owen, & Jones, 2016; Hagopian, Boelter, & Jarmolowicz, 2011; Hagopian et al., 1998; Hanley et al., 2001; Roane, Fisher, Sgro, Falcomata, & Pabico, 2004; Rooker, Jessel, Kurtz, & Hagopian, 2013).

Schedule thinning following FCT has become recognized as an important component of function-based treatments like FCT so that treated individuals do not request the functional reinforcer at rates that cannot be maintained by caregivers (e.g., requests for constant attention or a break from every task; Fisher et al., 1993; Hagopian et al., 1998, 2011). The schedule-thinning procedure for FCT that has the most empirical support involves (a) bringing the FCR under the discriminative control of a multiple schedule with signaled periods when reinforcement is available for the FCR (S^D) and when it is not (S^Δ; e.g., Fisher et al., 1998), and then (b) gradually increasing the duration of the extinction (EXT; or S^Δ) component of the multiple schedule (relative to the S^D component) until the desired endpoint is attained. For example, Hanley et al. (2001) initiated schedule thinning with a rich schedule of reinforcer deliveries (i.e., FR 1 for 45 s alternated with EXT for 15 s) and then progressed through seven intermediate steps until they reached the terminal schedule (i.e., FR 1 for 1 min alternated with EXT for 4 min). This terminal schedule was more practical than the initial schedule because (a) it maintained the strength of the FCR in the presence of the S^D, (b) it reduced reinforcer deliveries by approximately 90% from the initial thinning step, and (c) it allowed caregivers intervals of 4 to 8 min at a time during which no reinforcer deliveries were programmed, thus allowing them time to complete other routines.

More recently, Betz et al. (2013) evaluated a rapid method of schedule thinning for the FCR via stimulus-control procedures. These investigators demonstrated with four participants that after they observed high levels of discriminative control of the FCR during multiple-schedule training, they thinned the schedule of reinforcement in one large step (e.g., extending 1-min EXT components immediately to 4-min EXT components). This procedure consistently and rapidly reduced the overall rate of reinforcement for the FCR while the strength of the FCR was maintained in the presence of the S^D along with low rates of problem behavior. However, it should be noted that Betz et al. included contingency-specifying rules (verbal statements about what would happen following the FCR in the presence of the S^D and S^Δ) at the start of each multiple-schedule session, which probably facilitated discriminated responding for at least two (and perhaps all four) of the participants.

Most applications of multiple schedules have used therapist-arranged S^Ds that were salient and substantially different from one another and from other stimuli in the natural environment. For example, Fisher et al. (1998) used a drawing (15 cm by 21 cm) of a boy playing with toys on the wall as the S^D and the absence of the picture on the wall as the S^Δ. Other investigators have used different-colored floral leis (e.g., Tiger & Hanley, 2004), different-colored cards (e.g., Hanley et al., 2001), or different-colored wristbands (e.g., Betz et al., 2013) as the therapist-arranged S^D and S^Δ. The arrangement of salient and distinct stimuli that are not normal elements of the client's everyday environment has a strong foundation in the basic literature on stimulus control. That is, basic research has consistently found that the rate and degree of discrimination acquisition are generally inversely related to the degree of similarity of the S^D and S^Δ (e.g., Hanson, 1959; Hearst, 1968; Honig, 1961). Further, therapist-arranged stimuli can be used to program common stimuli (Stokes & Baer, 1977), thereby promoting generalization of FCT treatment effects from one therapist to another or from one setting to another (e.g., Fisher et al., 2015).

Nevertheless, several authors have described potential limitations of using therapist-arranged S^Ds during schedule thinning with FCT, including calling undue attention to a child with a disability, transportation and maintenance of the stimuli, and accurate timing and alternation of the stimuli according to the prescribed schedule (Hagopian et al., 2011; Kuhn, Chirighin, & Zelenka, 2010; Leon, Hausman, Kahng, & Becraft, 2010). Two recent investigations designed to address these potential limitations involved teaching clients whose destructive behavior was treated using FCT to request (and refrain from requesting) the functional reinforcer in the presence of naturally occurring S^Ds (i.e., those typically present in the client's everyday environment; Kuhn et al., 2010; Leon et al., 2010).

Kuhn et al. (2010) taught two children with autism or intellectual disabilities to request reinforcement when the therapist was engaged in a "nonbusy activity" (e.g., sitting and doing nothing) but not when the therapist was involved in a "busy activity" (e.g., cooking), with each component of the multiple schedule lasting 2.5 min. Both participants displayed considerably higher levels of the FCR during nonbusy times than during busy times. However, to decrease low levels of persistent FCRs (and problem behavior), one participant was given access to a highly preferred alternative item and the other was taught an observing response (i.e., asking the therapist, “Are you busy?”). Nevertheless, when the investigators implemented the final treatment package with two pairs of busy or nonbusy activities, treatment effects rapidly generalized to several other novel pairs. Leon et al. (2010) replicated the findings of Kuhn et al. with an 11-year-old boy with autism, intellectual disability, and bipolar disorder using 5-min multiple-schedule components and more varied generalization contexts.

It should be noted that the use of naturally occurring stimuli to signal the availability and unavailability of the functional reinforcer during schedule thinning with FCT might also have limitations. First, the participants in the Kuhn et al. (2010) and Leon et al. (2010) investigations all could follow multiple-step instructions and had limited to extensive vocal-verbal repertoires, and it therefore remains uncertain whether the studies would have produced comparable results with clients with poorer verbal repertoires. Second, for most of the activity pairs evaluated in the Kuhn et al. study, the therapist faced the client during nonbusy times and faced away from the child during busy times, which may have inflated the degree of discrimination relative to more subtle social cues exhibited by parents and other caregivers in the clients’ everyday environments. Finally, there are probably numerous caregiver behaviors that could be topographically similar but functionally different with respect to the availability of socially mediated reinforcement (e.g., a parent engaging in a busy activity that looks nonbusy or vice versa). For example, an adult playing a word game on a laptop computer (i.e., nonbusy) would be difficult to differentiate from the same adult typing a resume (i.e., busy). These scenarios could result in poorly discriminated FCRs, increases in problem behavior, or both.

Both therapist-arranged and naturally occurring S^Ds have been used successfully to promote (a) discriminative control of the FCR during FCT treatment of destructive behavior and (b) generalization of treatment effects to novel individuals and settings. Nevertheless, both types of S^Ds (arranged and naturally occurring) have their own potential limitations. Thus, additional research is needed to compare these two types of S^Ds directly during FCT treatment of destructive behavior. Therefore, the purposes of this current study were to evaluate the relative effects of therapist-arranged and naturally occurring S^Ds during FCT on (a) the speed of acquisition of discriminated FCRs, (b) the degree of generalization when introduced to novel contexts with varying levels of discriminability, and (c) the levels of problem behavior.

Experiment 1 consisted of an evaluation of FCT using multiple schedules with therapist-arranged and naturally occurring S^Ds across participants. Experiment 2 consisted of a posttraining generalization evaluation to assess the participants’ use of the FCR with both therapist-arranged and naturally occurring S^Ds for novel busy and nonbusy activities that were topographically similar (difficult discrimination pairs) or topographically dissimilar (easy discrimination pairs).

GENERAL METHOD

Participants and Setting

Three individuals, who had been admitted to intensive outpatient programs for the treatment of severe problem behavior, participated. We specifically selected participants who were similar to the ones in the Kuhn et al. (2010) and Leon et al. (2010) studies in terms of their listener repertoires (they followed multistep instructions) and verbal repertoires (they communicated with at least phrases). Maurice was a 5-year-old boy who had been diagnosed with autism spectrum disorder (ASD) and had been referred primarily for disruptive behavior. He could follow multistep instructions and communicated with three-to five-word vocal responses. Bernard was also a 5-year-old boy who had been diagnosed with ASD whose target responses included disruption and disruptive vocalizations (i.e., short, loud screams). He could follow multistep instructions and communicated expressively with three-to five-word vocal responses. Keith was a 10-year-old boy who was receiving treatment for self-injurious behavior (SIB), aggression, and disruption. Previous diagnoses included ASD and cerebral palsy. He spoke in two-to five-word phrases, could follow multistep instructions, and could sight read at the first-grade level. We conducted all sessions in individual therapy rooms (approximately 3 m by 3 m) with one-way observation panels to permit unobtrusive observation. Session rooms contained a table, chairs, and other relevant session materials (e.g., therapist activity materials). All sessions lasted 10 min, and we conducted approximately two to five sessions per day, 3 to 5 days per week.

Pretesting (Functional Analyses and FCT + EXT Evaluations)

For the purposes of this study, we included participants who (a) displayed problem behavior reinforced by social positive reinforcement as demonstrated by a functional analysis and (b) responded favorably to FCT + EXT (at least an 85% reduction from baseline). Thus, we conducted a functional analysis with each participant using procedures similar to those described by Iwata et al. (1982/1994) or a variation using a pairwise design (Iwata, Duncan, Zarcone, Lerman, & Shore, 1994) or a reversal design (Vollmer, Marcus, Ringdahl, & Roane, 1995). For all three participants, the functional analysis demonstrated that problem behavior was reinforced by social consequences (tangible reinforcement for all three participants; see Figure 1). We also conducted an FCT treatment evaluation using a reversal design with each participant to demonstrate that FCT + EXT was an effective treatment for problem behavior (see Figure 2).

Response Measurement and Interobserver Agreement

Trained observers recorded occurrences or durations of all participants' FCRs, problem behaviors during each component of the multiple schedule (busy = extinction interval and nonbusy = reinforcement interval), and procedural integrity measures of correct delivery of the S^D, correct delivery of the functional reinforcer, and the duration that therapists actually engaged in busy and nonbusy activities.

Maurice said "I want movie please" as his FCR. His problem behavior consisted of disruptions (forceful pulling on the therapist's body or attempts to pull items from the therapist's hand that resulted in movements greater than 2.5 cm).

Bernard said “movie please” as his FCR. His problem behavior was disruptive vocalizations (screams above a conversational level that lased 1 s to 3 s).

Keith said “I want the iPad please” as his FCR, and his problem behaviors included SIB (forceful contact of the hand against the head or body), aggression (hitting or attempting to hit another individual forcefully with an open or closed hand), and disruption (throwing items not made for that purpose 30.5 cm or more, but not directed at another person, and banging his hand on a table with his hand from a distance of 15 cm or more).

A second observer simultaneously and independently collected data during all analyses and treatment evaluations. Interobserver agreement was measured on 34%, 37%, and 40% of sessions for Maurice, Bernard, and Keith, respectively. We calculated interobserver agreement coefficients for frequency-based measures by dividing each session into a series of consecutive 10-s intervals and comparing the records for the two observers. Next, we scored an interval as an agreement if both observers scored the same frequency of target responses in that interval; we scored all other intervals as disagreements. We then calculated the agreement coefficient for each session by dividing the number of agreements by the number of agreements plus disagreements and converting the result to a percentage. We calculated interobserver agreement for the duration-based measures by dividing each session into consecutive 10-s intervals and comparing the records of the two observers. Within each 10-s interval, the smaller duration recorded (e.g., Observer A recorded 6 s) was divided by the larger duration recorded (e.g., Observer B recorded 7 s) to create a quotient (e.g., 6 ÷ 7 = 0.857). For intervals in which both observers recorded 0 s, a value of 1 (indicating perfect agreement) was recorded for that interval. We averaged these quotients within and then across sessions to obtain an overall measure of agreement for duration measures.

Mean agreement across sessions for FCRs was 98% (range, 96% to 100%) for Maurice, 94% (range, 88% to 100%) for Bernard, and 98% (range, 97% to 100%) for Keith. Mean agreement for disruptions for Maurice was 89% (range, 76% to 100%). Mean agreement for Bernard’s disruptive vocalizations was 94% (range, 88% to 100%). For Keith, mean agreement was 99% (range, 92% to 100%) for disruptions, 98% (range, 93% to 100%) for SIB, and 99% for aggression (range, 99% to 100%).

We also collected data on the procedural integrity of the therapist’s correct delivery of the S^Ds and the reinforcer, and the amount of time each therapist engaged in either a busy or nonbusy activity during the session. Mean integrity for correct delivery of the S^D and the reinforcer averaged 98% (range, 98% to 100%) for Maurice, 98% (range, 98% to 100%) for Bernard, and 94% (range, 84% to 100%) for Keith. Mean agreement for engagement in busy and nonbusy activities averaged 97% (range, 89% to 99%) for Maurice, 99% (range, 91% to 100%) for Bernard, and 98% (range, 88% to 100%) for Keith.

Design

In Experiment 1, we exposed all three participants to two conditions. One condition consisted of FCT using a multiple schedule (mult FR 1 150 s/FR 1 150 s) with naturally occurring S^Ds correlated with the busy or nonbusy activities based on the procedures described by Kuhn et al. (2010; see Table 1 for the activities). The second condition consisted of FCT using a multiple schedule (mult FR 1 60 s/FR 1 60 s) with therapist-arranged S^Ds based on the procedures described by Betz et al. (2013).

We matched the durations of the schedule components based on prior research in Experiment 1 because our goal was to evaluate how quickly participants acquired discriminated responding with each procedure based on their descriptions in prior research, and we thought that changing the schedule duration of one or both procedures could potentially affect rates of acquisition. However, in Experiment 2 (conducted with Bernard and Keith) we decided to equate component duration (mult FR 1 150 s/EXT 150 s) for both the naturally occurring and therapist-arranged conditions because the purpose of this experiment was to test the degree of generalization after initial training (and if one procedure resulted in greater generalization, it should do so independent of component length). In addition, the Betz et al. (2013) procedure ended after the multiple schedule was changed to a mult FR1 60 s/EXT 240 s so the durations of the EXT components were not substantially different for the Kuhn et al. (2010; 150 s) and Betz et al. (240 s) procedures at the completion of each intervention.

During Experiment 1, we compared the rates of acquisition of discriminated FCRs to baseline using a nonconcurrent multiple baseline design, and we compared the two treatment conditions (arranged vs. naturally occurring S^Ds) using a multielement design. During Experiment 2, levels of generalization across easy and difficult conditions were compared using a reversal (ABAB) design, and the two treatment conditions (arranged vs. naturally occurring) were compared using a multielement design within each phase. The easy and difficult pairs of busy and nonbusy activities used in Experiment 2 are listed in Table 1.

EXPERIMENT 1

Method

Baseline for the naturally occurring S^D condition—We randomly selected two of the easy pairs of busy and nonbusy activities listed in Table 1 for each participant (henceforth referred to as Pair 1 and Pair 2). Baseline sessions lasted 10 min and were divided into four 2.5-min intervals. In two of these intervals, the therapist engaged in the busy and nonbusy activities of Pair 1, and in the remaining two intervals, the therapist engaged in the busy and nonbusy activities of Pair 2. We randomized the sequence of components so that (a) Pair 1 was implemented first for about half of the sessions and Pair 2 for the other half and (b) about half of the sessions started with a busy activity and the remaining half started with a nonbusy activity. If the participant emitted the FCR, the therapist immediately provided the functional reinforcer for 30 s regardless of whether the therapist was engaged in a busy or a nonbusy activity (i.e., baseline consisted of nondifferential reinforcement). Problem behavior produced no programmed consequence (EXT) throughout all phases of the analysis.

Baseline for the arranged S^D condition—Each baseline session lasted 10 min, divided into 10 intervals (60 s each) in accordance with a mult FR 1 60 s/FR 1 60 s arrangement (i.e., baseline consisted of nondifferential reinforcement). We signaled one component of the multiple schedule by the presence of a therapist-arranged S^D (a colored bracelet worn by the therapist and kept in clear sight of the participant), and the other component was signaled by the absence of that stimulus (a bare wrist kept in clear sight of the participant, which would subsequently become the S^{Δ} during treatment). As in the Betz et al. (2013) study, we selected these S^Ds based on parental reports of what type of stimulus would likely be both effective and acceptable in the natural environment.

We began each baseline session with a 60-s component with the arranged S^D present (i.e., bracelet on), immediately followed by a second 60-s component with that stimulus absent (i.e., bare wrist). After these first two components of the multiple schedule, we alternated the remaining components in a quasirandomized fashion, with the criterion that neither component occurred consecutively for more than two intervals. If the participant emitted the FCR, the therapist immediately provided the functional reinforcer for 20 s regardless of whether the therapist was wearing the bracelet or not. During both multiple-schedule components of the arranged S^D condition, the therapist applied and removed the wristband according to the multiple schedule and delivered the tangible item contingent on the FCR, but otherwise did not attend to the participant and did not engage in any of the busy or nonbusy activities from the naturally occurring S^D condition. As indicated above, problem behavior produced no programmed consequence (EXT) throughout all phases.

Multiple-schedule training in the naturally occurring S^D condition—This condition was identical to the baseline for the naturally occurring S^D condition with one exception: The therapist delivered the functional reinforcer if the participant emitted an FCR when the therapist was engaged in a nonbusy activity but not when the therapist was engaged in a busy activity.

Multiple-schedule training in the arranged S^D condition—This condition was identical to the baseline for the arranged S^D condition with two exceptions: (a) Immediately before starting the session clock, the therapist showed the bracelet (or S^D) to the participant and provided the rule, “When the bracelet is on, you can ask me for [e.g., movie] and I will give it to you. When the bracelet is off, you can ask me for [e.g., movie], but I will not give it to you”; and (b) the therapist delivered the functional reinforcer if the participant emitted an FCR when the therapist was wearing the bracelet (S^D) but not when the therapist was not wearing the bracelet (i.e., bare wrist = S^{Δ}).

Response blocking (Keith only)—Due to a potentially dangerous increase in both the frequency and severity of Keith’s SIB at the start of multiple-schedule training with the naturally occurring stimuli, we added a response-blocking procedure to both multiple-schedule training procedures. With each attempted SIB, the therapist placed his or her hand between Keith’s hand and the targeted body part to prevent or mitigate SIB that occurred with a force that was likely to cause significant tissue damage. We introduced response blocking in both conditions to maintain consistency across conditions and also as a safety precaution. We did not block any other topographies of problem behavior.

Mastery criteria and termination of training—Training continued for a minimum of eight sessions or until the participant met either of two mastery criteria in either the arranged S^D or the naturally occurring S^D condition (i.e., 80% of the FCRs occurring in the S^D

component for three consecutive sessions or 100% of the FCRs occurring in the S^D component for two consecutive sessions). In addition, we extended training if the trends in the data suggested that the participant would likely show mastery performance in both conditions if we conducted a few additional sessions in each condition. We extended training in this manner for Pairs 1 and 2 for Maurice, Pair 2 for Bernard, and Pair 1 for Keith. We did not extend training beyond eight sessions per condition with Pair 1 for Bernard because he did not show 80% or more of his FCRs in the presence of the S^D in any of the naturally occurring S^D sessions.

Results and Discussion

Figure 3 shows the percentage of FCRs that occurred in the presence of the arranged and naturally occurring S^Ds across baseline and treatment phases. We calculated the percentages of correct FCRs by dividing the number of FCRs that occurred in the presence of the S^D by the total number of FCRs that occurred in a given session and converting the result to a percentage. As expected, during baseline, when FCRs produced reinforcement in each component of each multiple schedule, levels of FCRs during exposure to Pairs 1 and 2 with therapist-arranged and naturally occurring S^Ds were at or close to 50% for all three participants.

With the introduction of training for Pair 1 in Phase 2, Maurice (top panel) showed roughly equivalent levels of acquisition of discriminated FCRs in the arranged and naturally occurring conditions at approximately equal rates (arranged S^D, M = 76%, reached mastery performance in eight sessions; naturally occurring S^D, M = 78%, reached mastery performance in six sessions). With the introduction of treatment for Pair 2 in Phase 3, Maurice again showed similar levels of discriminated FCRs in the therapist arranged and naturally occurring S^D conditions (arranged S^D, M = 86.5%, reached mastery performance in 10 sessions; naturally occurring S^D, M = 90%, reached mastery performance in seven sessions).

Following training sessions in which the therapist provided access to the functional reinforcer only in the presence of the arranged and naturally occurring S^Ds, Bernard and Keith showed more rapid discrimination and greater percentages of FCRs in the arranged S^D condition than in the natural S^D condition. Bernard (Figure 3, middle) emitted a greater percentage of his FCRs in the presence of the arranged S^D than in the naturally occurring S^D during training with Pair 1 (arranged S^D, M = 78%; naturally occurring S^D, M = 50.6%) and Pair 2 (arranged S^D, M = 84.4%; naturally occurring S^D, M = 71%). Furthermore, Bernard met the mastery training criterion of three consecutive sessions with 80% or greater of FCRs occurring in the presence of the S^D in the arranged S^D condition (arranged S^D sessions, n =7) but did not meet mastery criteria for discrimination during training for Pair 1 in the naturally occurring S^D condition. During training with Pair 2, Bernard demonstrated mastery performance in the arranged S^D condition in the first three sessions. By contrast, he required more than four times as many sessions (n = 13) to reach the mastery criterion with the naturally occurring S^Ds for Pair 2.

Keith also demonstrated greater levels of discriminated responding in the arranged S^D condition than in the naturally occurring S^D condition during training with Pair 1 (arranged

S^D, $M = 90\%$; naturally occurring S^D, $M = 78\%$) and Pair 2 (arranged S^D, $M = 96\%$; naturally occurring S^D, $M = 86\%$). He met mastery criteria in the arranged S^D condition after the first four training sessions with Pair 1 and after the first three training sessions with Pair 2. He required more training sessions ($n = 10$) to reach mastery performance with Pair 1 in the naturally occurring S^D condition but not with Pair 2 ($n = 4$).

Figure 4 shows the mean rates of FCRs in the arranged and naturally occurring S^D conditions during baseline and the multiple-schedule phases of Experiment 1. The participants displayed higher rates of FCRs during baseline and the arranged S^Ds than in the naturally occurring S^Ds. We expected these differences during the baselines, because the reinforcement intervals in the arranged S^D condition lasted 20 s, whereas in the naturally occurring S^D condition they lasted 30 s (and participants rarely emitted an FCR during the reinforcement interval). In addition, rates of FCRs in the S^D components of the multiple schedules were maintained at levels similar to those observed during baseline for both the arranged S^Ds (white bars) and naturally occurring S^Ds (black bars), indicating that the introduction of EXT during the multiple schedules did not suppress responding during the reinforcement components of either multiple schedule. Finally, the mean rates of FCRs during the EXT components decreased by about half during multiple-schedule training with Pair 1 using the arranged S^Ds and by about another half when we used arranged S^Ds with Pair 2 (hashed bars). By contrast, rates of FCRs in the EXT components persisted at relatively higher levels when we conducted multiple-schedule training with naturally occurring S^Ds (dotted bars).

As mentioned above, we extended training after a participant met one of the mastery criteria in one of the conditions if the data trends suggested that the participant would likely meet one of the mastery criteria in the other condition after a few more sessions. As a result, the only time that a participant failed to meet mastery criterion was for Pair 1 in the naturally occurring S^D for Bernard. It is possible that, had we conducted more training sessions, he would have eventually demonstrated mastery performance for Pair 1 in the naturally occurring S^D condition. However, we ended the training after eight sessions because he never displayed more than 70% of his FCRs in the presence of the S^D in any of the eight sessions in the naturally occurring S^D condition.

Figure 5 depicts rates of problem behavior during baseline and the multiple-schedule training sessions across activity pairs for arranged and naturally occurring S^D conditions. Levels and patterns of problem behavior varied widely and inconsistently across participants, phases, and conditions. Maurice (top panel) displayed zero rates of disruption during baseline in both conditions. When treatment was initiated with Pair 1, his disruption increased substantially at the start of the phase and subsequently decreased in both the arranged and naturally occurring S^D conditions (arranged S^D, $M = 0.65$; naturally occurring S^D, $M = 0.78$). When treatment was initiated with Pair 2, disruption similarly increased and then decreased in the arranged S^D condition, but disruption remained fairly low throughout the phase in the naturally occurring S^D condition (arranged S^D, $M = 0.55$; naturally occurring S^D, $M = 0.2$).

With the exception of a few individual sessions, Bernard (Figure 5, middle) showed relatively low rates of disruptive behavior during all baseline and multiple-schedule training sessions in both the arranged and naturally occurring S^D conditions. Keith, by contrast, showed near-zero levels of problem behavior in both conditions during baseline, but then showed a fairly large increase when multiple-schedule training was introduced in the arranged S^D condition (M = 8.5 for the first three sessions) and a much larger increase when multiple-schedule training was introduced in the naturally occurring S^D condition (M = 36.6 for the first three sessions). By the end of this first treatment phase, Keith's problem behavior decreased to near-zero levels in both the arranged and naturally occurring S^D conditions, and it remained low in both conditions in the next phase when multiple-schedule training was implemented with Pair 2.

Overall, results in Experiment 1 varied substantially across participants. Maurice showed roughly equivalent increases in the levels of discriminated FCRs when multiple-schedule training was introduced using arranged and natural FCRs, and he showed resurgence of problem behavior in both the naturally occurring and arranged S^D conditions during the first treatment phase and again in the arranged S^D condition in the second treatment phase. Resurgence is a behavioral phenomenon in which introduction of a disrupter (e.g., EXT) following differential or response-independent reinforcement (e.g., FCT) results in an increase in (or the reemergence of) a previously extinguished response (e.g., problem behavior; Mace et al., 2010; Nevin & Shahan, 2011; Volkert, Lerman, Call, & Trosclair-Lasserre, 2009; Wacker et al., 2013). Bernard showed more rapid acquisition of discriminated FCRs in the arranged S^D condition than in the naturally occurring S^D condition (and only reached mastery performance with one of the two busy and nonbusy pairs in this latter condition), but he did not display resurgence of problem behavior in either condition. Finally, Keith showed more rapid acquisition of discriminated FCRs in the arranged S^D condition than in the naturally occurring S^D condition, but he showed mastery performance in both, and he showed resurgence during the first phase of multiple-schedule training in both the arranged and naturally occurring S^D conditions, but the levels of resurgence were dramatically greater in the naturally occurring S^D condition (exceeding 50 responses per minute in the first multiple-schedule training session). These results suggest that the use of arranged S^Ds may result in more rapid establishment of discriminated FCRs for some individuals; however, neither procedure prevented resurgence of problem behavior when signaled components were introduced during which the FCRs were correlated with EXT. Given the variability in the magnitude of resurgence across participants (and whether it occurred at all), these results suggest that additional research is needed to better understand the variables that affect resurgence in clinical populations.

EXPERIMENT 2: POSTTRAINING GENERALIZATION ANALYSIS

Bernard and Keith completed the posttraining generalization analysis but Maurice did not due to scheduling conflicts. After Bernard and Keith each demonstrated mastery performance for both Pair 1 and Pair 2 during multiple-schedule training, we exposed them to new pairs of stimuli that varied in level of difficulty. The purpose of this experiment was to evaluate the conditions under which training naturally occurring and arranged S^Ds in the context of a multiple schedule would occasion appropriate use of the trained FCR while low levels of problem behavior were maintained when participants were presented with novel contexts that differed in terms of ease of discriminability (easy vs. difficult).

Method: Busy and Nonbusy Generalization Activities

Table 2 lists the specific busy and nonbusy activities that we used for Bernard and Keith to test for generalization during Experiment 2. The left side of Table 2 shows busy and nonbusy tasks that are similar or identical to ones used in the Kuhn et al. (2010) investigation. These busy and nonbusy tasks are labeled "easy" because we hypothesized that participants should more readily discriminate or show generalization for these activity pairs after training in Experiment 1. The right side of Table 2 shows busy and nonbusy tasks that share many more common physical features between each pair than the ones used by Kuhn et al. We labeled these tasks as "difficult" because we hypothesized that participants should less readily discriminate or show limited generalization for these pairs after training in Experiment 1. By contrast, we hypothesized that the arranged S^D would promote generalization more readily for both the easy and difficult busy and nonbusy pairs because stimulus control of the FCR was tied to the presence or absence of the arranged S^D rather than how similar or different the activities appeared.

Naturally occurring S^Ds with easy busy and nonbusy pairs—Sessions with naturally occurring S^Ds with easy busy and nonbusy pairs were identical to training sessions in Phase 1 with naturally occurring S^Ds, except that we presented two different easy pairs (henceforth called Pairs 3 and 4) in each session (with the busy and nonbusy components of Pairs 3 and 4 each presented for 2.5 min in a 10-min session). Sessions began when the therapist entered the session room with the participant and materials for the assigned pairs of busy and nonbusy activities. If the participant emitted the FCR during a nonbusy activity, the therapist provided access to a video (i.e., the functional reinforcer) for 30 s. If the participant emitted the FCR during intervals in which the therapist was engaged in a busy behavior, the therapist ignored the participant's requests (i.e., differential reinforcement was in place throughout the generalization analysis).

Naturally occurring S^Ds with difficult busy and nonbusy pairs—Sessions with naturally occurring S^Ds with difficult busy and nonbusy pairs were identical to sessions with easy pairs described above, except that we used the specific difficult pairs identified for each participant in Table 2.

Arranged S^Ds with easy busy and nonbusy pairs—During sessions with arranged S^Ds with easy busy and nonbusy pairs, we randomized the therapist activity type in a similar fashion to procedures described above for the naturally occurring S^Ds. Sessions were similar to conditions described above for naturally occurring S^Ds, except that we paired the busy and nonbusy activities with the arranged stimuli used in Experiment 1. Sessions began when the therapist entered the session room with the participant and materials for the assigned pairs of busy and nonbusy activities. The therapist presented the same arranged S^D (bracelet) used in the arranged S^D training of Experiment 1 that signaled when reinforcement was available. The therapist overtly showed the arranged S^D to the participant and provided the rule, “When the bracelet is on, you can ask me for the video and I will give it to you. When the bracelet is off, you can ask me for the video, but I will not give it to you.”

If the participant emitted the FCR during a nonbusy activity (arranged S^D present; i.e., arm with bracelet on), the therapist provided access to the preferred video for 30 s. If the participant emitted the FCR during intervals in which the therapist was engaged in a busy behavior (arranged S^Δ present; i.e., bare wrist), the therapist ignored the his requests.

Arranged S^Ds with difficult busy and nonbusy pairs—For both participants, sessions with arranged S^Ds with difficult busy and nonbusy pairs were identical to sessions with easy pairs described immediately above, except that we used the difficult pairs shown in Table 2. It is important to note that, different from Experiment 1, during both multiple-schedule components of the arranged S^D conditions (with easy and difficult pairs) in Experiment 2, when the therapist applied the bracelet, the therapist also engaged in the nonbusy activity, and when the therapist removed the bracelet, the therapist also engaged in the busy activity.

Response blocking (Keith only)—The response-blocking procedure used for Keith was identical to that described in Experiment 1.

Results and Discussion

Figure 6 shows the levels of discriminated FCRs for Bernard and Keith during posttraining generalization sessions for easy and difficult pairs of therapist activities with naturally occurring and arranged S^Ds. In the naturally occurring S^D condition, more of Bernard’s FCRs were allocated in the presence of the S^D with the easy discrimination pairs (*M*s = 87.5% and 77.5% in Phases 1 and 3, respectively) than with the difficult discrimination pairs (*M*s = 56.7% and 39.9% in Phases 1 and 3, respectively). In contrast, in the arranged S^D condition, Bernard demonstrated similar levels of FCRs in the presence of the S^D with the easy pairs (*M*s = 89.7% and 100% in Phases 2 and 4, respectively) and the difficult pairs (*M*s = 82.3% and 86.5% in Phases 2 and 4, respectively).

When we exposed Keith to the easy and difficult discrimination pairs during the first phase, he demonstrated near-chance correct responding to the naturally occurring S^D conditions (easy pairs, *M* = 60%; difficult pairs, *M* = 51%). However, during the second phase, correct responding increased for both the easy (*M* =93.6%) and difficult (*M* = 78.6%) pairs. During the third phase when the naturally occurring S^D condition was reintroduced, correct FCRs decreased with both the easy (*M* = 76.9%) and difficult (*M* = 58.5%) pairs. Finally, reintroduction of the arranged S^D condition in the fourth phase again increased correct FCRs with both the easy (*M* = 93.2%) and difficult (*M* = 90.7%) pairs.

Problem behavior for Keith is depicted in Figure 7. Bernard’s disruptive behavior remained at zero or near-zero rates throughout Experiment 2 and is therefore not shown. Keith’s disruptive behavior increased dramatically with both the easy (*M* = 7.8) and difficult (*M* = 7.6) pairs with the naturally occurring S^Ds in the first phase of Experiment 2 relative to the last phase of Experiment 1 (i.e., resurgence of problem behavior occurred when these new pairs were introduced). In contrast, disruptive behavior decreased markedly when the arranged S^D condition was introduced in the second phase for both the easy (*M* = 0.9) and difficult (*M* = 0.7) pairs. Disruptive behavior remained relatively low except during one session (Session 21) in the third phase when we reintroduced the naturally occurring S^D condition for both the easy and difficult pairs (*M*s = 0.7 and 3.6, respectively). Finally, disruptive behavior remained low in the final phase when we reintroduced the arranged S^D condition except for two sessions (Sessions 28 and 31) for both the easy (*M* = 1.5) and difficult (*M* = 0.2) pairs.

Results for both participants were consistent with our hypothesis that arranged S^Ds would promote greater generalized effects, particularly for pairs of activities that were difficult to discriminate. These results suggest that arranged S^Ds might facilitate discrimination regarding when reinforcement is available and unavailable for the FCR in novel contexts. These findings replicate and extend previous research on the benefits of establishing stimulus control of the FCR using arranged S^Ds (Betz et al., 2013; Fisher et al., 2015; Greer et al., 2016; Hanley et al., 2001).

GENERAL DISCUSSION

In Experiment 1, we taught three participants with problem behavior to access the functional reinforcer via an FCR. Next, we taught them that the FCR produced reinforcement in one component of a multiple schedule (i.e., when the adult was engaged in a nonbusy activity) but not in the other (i.e., when the adult was engaged in a busy activity) using either naturally occurring S^Ds (i.e., the busy and nonbusy activities themselves) or therapist-arranged S^Ds (i.e., the adult wore a bracelet during nonbusy activities and had a bare wrist during busy activities). For one participant (Bernard), discrimination training with arranged S^Ds proved to be both more effective (he reached mastery performance with both activity pairs rather than just one) and more efficient (he reached mastery performance more rapidly) than with the naturally occurring S^Ds. For a second participant (Keith), both procedures were equally effective (he reached mastery performance for both pairs) but discrimination training was more efficient (i.e., proceeded more rapidly) with the arranged S^Ds than with the naturally occurring S^Ds. With the third participant (Maurice), both procedures produced discriminated FCRs with roughly equal effectiveness and efficiency. With regard to problem behavior, the introduction of periods of EXT for the FCR during discrimination training produced resurgence of problem behavior for two participants (Maurice and Keith) with both the arranged and naturally occurring S^Ds.

In Experiment 2 we compared the effects of the arranged and naturally occurring S^Ds with novel pairs of stimuli that differed in terms of the discriminability of the busy and nonbusy activities (easy vs. difficult) with two of the participants (Keith and Bernard). Keith showed higher levels of discriminated responding with both the easy and difficult activity pairs in the arranged S^D condition than in the naturally occurring S^D condition. Bernard showed only slightly better discriminated responding in the arranged S^D condition with the easy activity pairs, but substantially better discriminated responding in the arranged S^D condition with the difficult activity pairs. With respect to problem behavior, Keith (but not Bernard) displayed resurgence when we initially introduced novel easy and difficult pairs of activities using naturally occurring S^Ds, but levels of problem behavior decreased markedly for these same activities when we introduced arranged S^Ds.

The results of Experiments 1 and 2 replicate and extend the findings of prior research on schedule thinning in several ways. First, these results partially replicate the Kuhn et al. (2010) findings by showing that it is possible to establish discriminated responding with FCRs using explicit therapist activity (i.e., naturally occurring S^Ds) to signal the availability and unavailability of reinforcement for some individuals and with some adult busy and nonbusy activities. However, the current results also suggest that for some individuals the use of programmed S^Ds (i.e., arranged S^Ds plus verbal specification of the contingency) may establish discriminated responding for the FCR more rapidly or more fully and facilitate generalization to novel busy and nonbusy activities, especially activities that are less discriminable.

The increased facilitation of generalization with arranged S^Ds relative to naturally occurring S^Ds should be considered relative to the characteristics of the participants in the current and prior investigations. The participants in the current study, as well as those in Kuhn et al. (2010) and Leon et al. (2010), all could follow multistep instructions and had limited to extensive vocal-verbal repertoires, whereas participants in most other studies on schedule thinning during FCT have included at least some participants who were considerably lower functioning (e.g., Betz et al., 2013; Fisher, Greer, Querim, & DeRosa, 2014; Greer et al., 2016; Hagopian et al., 1998; Hanley et al., 2001; Rooker et al., 2013). Thus, the fact that the current participants had difficulty discriminating the novel, naturally occurring stimuli (especially those categorized as difficult) suggests that individuals who are lower functioning may have even more difficulty in making such discriminations. By contrast, arranged S^Ds have typically resulted in clearer discriminated responding for the FCR with both higher functioning and lower functioning individuals. For example, Greer et al. (2016) summarized the results of 25 consecutive applications of multiple and chained schedules using arranged S^Ds, and by the end of treatment almost all of the FCRs occurred in presence of the S^D across participants (M = 92%). In a minority of applications, Greer et al. switched to response restriction, in which they presented the response card used for the FCR only during the S^D component in order to prevent FCRs during the EXT component of the multiple schedule (e.g., Fisher et al., 2014; Roane et al., 2004). In another recent study, Fisher et al. (2015) showed that the use of arranged S^Ds facilitated rapid transfer of discriminated FCRs and low levels of problem behavior across settings and therapists. The current results are consistent with both earlier and more recent investigations on the effectiveness and generality of schedule thinning using arranged S^Ds during treatment of problem behavior with FCT.

Kuhn et al. (2010) supplemented their procedure with one participant (Greg) by teaching him to ask the adult, "Are you busy?," which resulted in highly discriminated FCRs (i.e., nearly all FCRs occurred in the presence of the S^D) and near-zero levels of problem behavior. Moreover, this participant primarily asked this question when the adult was engaged in nonbusy activities, suggesting that this observing response may have facilitated discrimination of the naturally occurring S^Ds associated with the busy and nonbusy activities. We elected not to include this observing response in the current investigation because it was used with just one participant in the Kuhn et al. study, it was not used in the follow up study by Leon et al. (2010), and it had never been used in prior research on arranged S^Ds. Future researchers may wish to compare the initial and generalized effects of arranged and naturally occurring S^Ds when these procedures are and are not supplemented with an observing response.

It is both noteworthy and somewhat discouraging that we observed rather dramatic levels of resurgence of problem behavior for two of the three participants when we introduced the multiple schedules with both the naturally occurring and arranged S^Ds. Recent studies on the effects of differential reinforcement interventions like FCT on resurgence of problem behavior have shown that substantial increases in problem behavior can occur when reinforcement of the alternative response is withdrawn (i.e., EXT) or thinned abruptly (e.g., Mace et al., 2010; Volkert et al., 2009; Wacker et al., 2013). However, when multiple schedules have been used to introduce periods of EXT, problem behavior has generally remained relatively low (e.g., Betz et al., 2013). Moreover, when periods of EXT have been introduced in studies that have compared mixed and multiple schedules during FCT schedule thinning, mixed schedules more often have been associated with higher levels of resurgence relative to multiple schedules (e.g., Hanley et al., 2001, participant Jake; Jarmolowicz, DeLeon, & Contrucci-Kuhn, 2009). Factors that may have contributed to the unusually high levels of resurgence in two of the participants in the current investigation include (a) a high rate of reinforcement for problem behavior during the baseline phases of Experiment 1 (i.e., FR 1); (b) a high rate of reinforcement for the FCR during the treatment phases of Experiment 1 and the baseline phase of Experiment 2 (i.e., FR 1); and (c) a relatively short exposure to FCT (with EXT of problem behavior) before the introduction of periods of EXT for the FCR when the multiple schedules were first implemented (see Nevin & Shahan, 2011, for a discussion of the effects of these variables on resurgence).

Another factor that may have contributed to the high levels of resurgence observed with Maurice and Keith was the initial durations of the EXT components of each multiple schedule (i.e., 2.5 min for the naturally occurring S^D condition and 1 min for the arranged S^D condition). Schedule-thinning procedures for FCT in many studies have begun with a shorter initial duration for the EXT component (e.g., 15 s) and longer initial durations for the reinforcement component (e.g., 45 s; Hagopian et al., 2005; Hanley et al., 2001; Jarmolowicz et al., 2009; Sidener, Shabani, Carr, & Roland, 2006). Had we started with much shorter EXT components, it is possible that resurgence would have been mitigated (or even prevented) for these two participants. This interpretation is supported in part by the fact that resurgence of problem behavior occurred with both participants in the Kuhn et al. (2010) study when the experimenters introduced the naturally occurring S^D multiple schedule with 2.5 min EXT components. However, Betz et al. (2013) introduced multiple schedules with arranged S^Ds with 1 min EXT components, and problem behavior remained at least 90% below baseline rates for all four participants. In addition, neither the 1 min (with arranged S^Ds) nor the 2.5 min (with naturally occurring S^Ds) resulted in resurgence of problem behavior with the third participant in the current investigation (Bernard).

These differences across and within studies with respect to to which shorter and longer initial EXT components resulted in less and more resurgence of problem behavior, respectively, suggest that additional procedures may be needed to select the initial component lengths for multiple schedules used during schedule thinning for FCT. For example, initial schedule densities for treatments that involve time-based delivery of reinforcement (i.e., noncontingent reinforcement) before schedule thinning have been selected on the basis of latency to problem behavior or mean interresponse times for problem behavior (e.g., Kahng, Iwata, DeLeon, & Wallace, 2000; Lalli, Casey, & Kates, 1997). It is possible that these procedures might prove to be useful for selecting the initial length of the EXT component when multiple schedules are used to thin reinforcement during treatment with FCT. Future research should examine whether these or similar procedures could prevent or mitigate resurgence of problem behavior when the FCR is first exposed to periods of EXT at the start of schedule thinning during FCT.

Results of the current investigation should be interpreted relative to several limitations. First, it should be noted that we applied a response-blocking procedure only with Keith (based on his unique circumstances). Therefore, reductions in problem behavior during the multiple-schedule conditions for this participant may be more directly related to the addition of response blocking rather than FCT and EXT per se. Response blocking may produce behavior-reductive effects via EXT, punishment, or both (Lerman & Iwata, 1996; Smith, Russo, & Le, 1999), and we did not evaluate which of these operant mechanisms affected Keith's problem behavior. Future research should determine the operant mechanisms involved in response blocking when it is added to an FCT package.

Second, variability in the patterns of responding for each participant during training, in combination with the small number of participants, may reduce the generality of the conclusions that can be made concerning the efficacy of one multiple-schedule training procedure versus another. In addition, it is possible that the specific busy and nonbusy activities used in the current study contributed to the observed response variability. Therefore, future research should compare naturally occurring and arranged S^Ds with a larger cohort of participants and with a larger pool of busy and nonbusy activities.

Third, we presented contingency-specifying rules only in the arranged S^D condition. We conducted our arranged S^D condition based on the procedure by Betz et al. (2013), which included contingency-specifying rules. We conducted our naturally occurring S^D based on the procedures described by Kuhn et al. (2010), which did not include contingency-specifying rules. However, results of prior research suggest that providing contingency-specifying rules may facilitate discrimination of compound schedules (e.g., Tiger & Hanley, 2004). Thus, it is unclear whether we would have obtained better results with the naturally occurring S^Ds if we had included contingency-specifying rules with that multiple-schedule arrangement. For example, parents often signal periods when they are unavailable to interact with (or deliver reinforcers to) their children by saying statements like "Not now, I'm working." For children with at least some rule-governed responding in their behavioral repertoire, such a statement may function as an effective S^Δ if the parent thereafter consistently ignores the child's mands until the completion of the busy activity. Therefore, future research should examine whether and to what extent contingency-specifying rules facilitate the discrimination of naturally occurring S^Ds.

Lastly, we debated whether to match the durations of the schedule components in Experiment 1 across conditions or keep them identical to those used in prior research. Each approach has benefits and limitations. Although we equated the rates and amounts of reinforcement available in the two conditions, it is possible that the different schedule-component durations (e.g., 1 min vs. 2.5 min) differentially affected acquisition of discriminated responding. Therefore, future research should evaluate whether shorter or longer schedule-component durations facilitate or impede the acquisition of discriminated FCRs.

In summary, determination of the most effective procedures for training alternative communicative responses and their use in natural environments continues to be important for increasing independent functioning of individuals who exhibit severe problem behavior. The current study provides some support for the limited use of naturally occurring S^Ds, but perhaps somewhat more support for the use arranged S^Ds, especially when FCT is initially transferred to busy and nonbusy activities that are difficult to discriminate. Based on these preliminary findings comparing naturally occurring and arranged S^Ds, as well as the larger body of extant research on arranged S^Ds and natural occurring S^Ds, it may be prudent to introduce schedule thinning with arranged S^Ds and to initiate fading from arranged to natural occurring S^Ds somewhat later in the treatment process (especially with busy and nonbusy activities that are difficult to discriminate).

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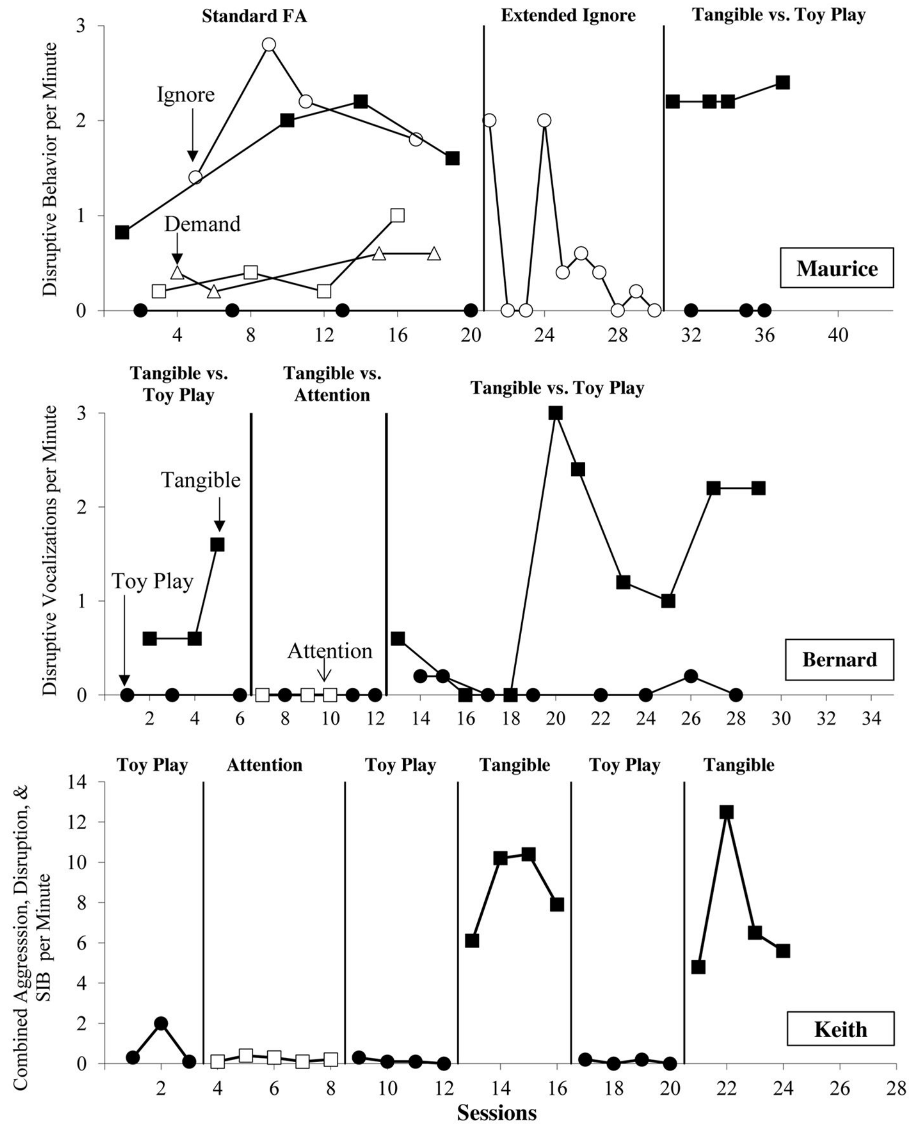

Figure 1.

Responses per minute of problem behavior during the functional analyses for Maurice (top), Bernard (middle), and Keith (bottom).

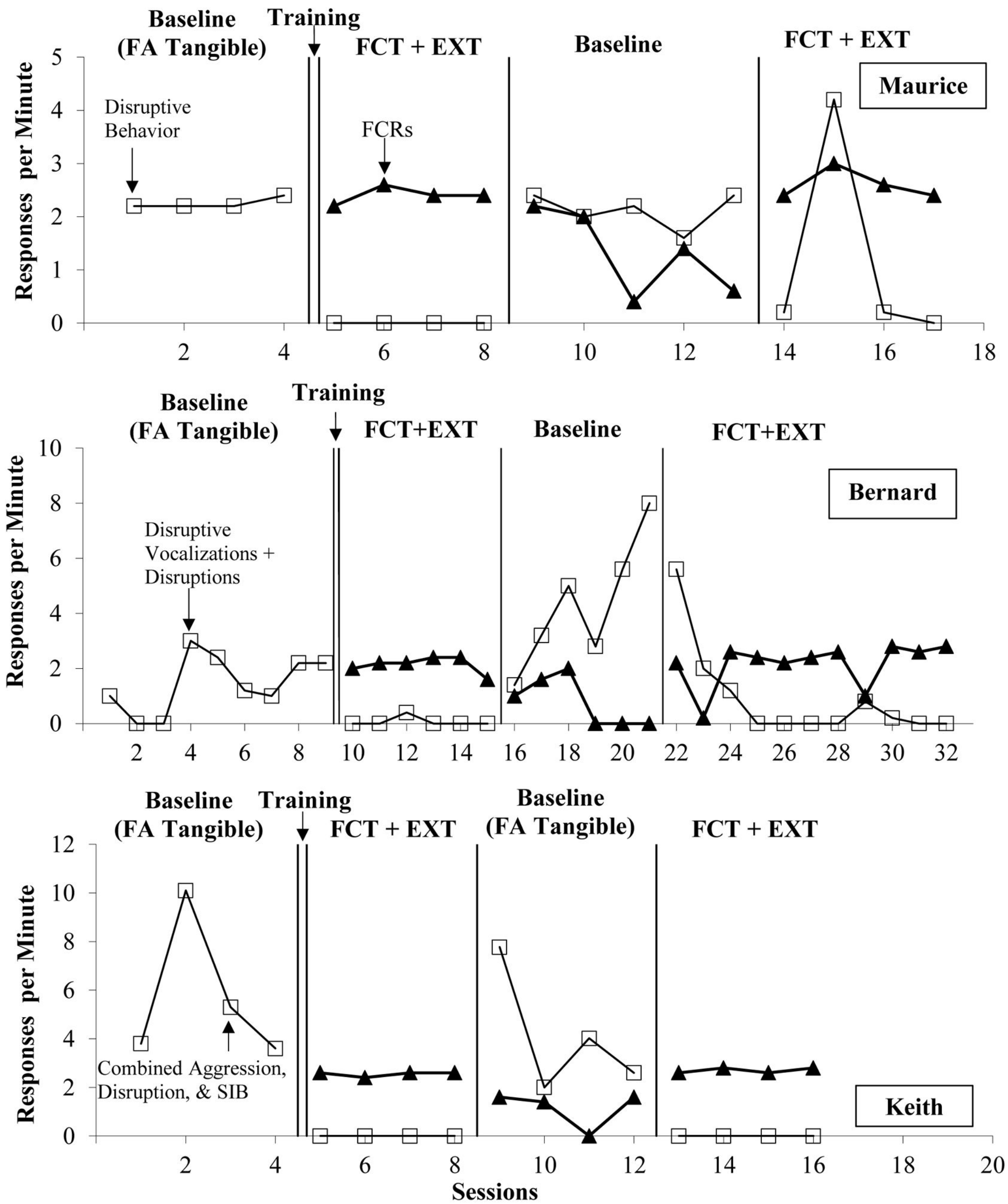

Figure 2.

FCT treatment evaluation: Responses per minute during FCT + EXT for Maurice (top), Bernard (middle), and Keith (bottom).

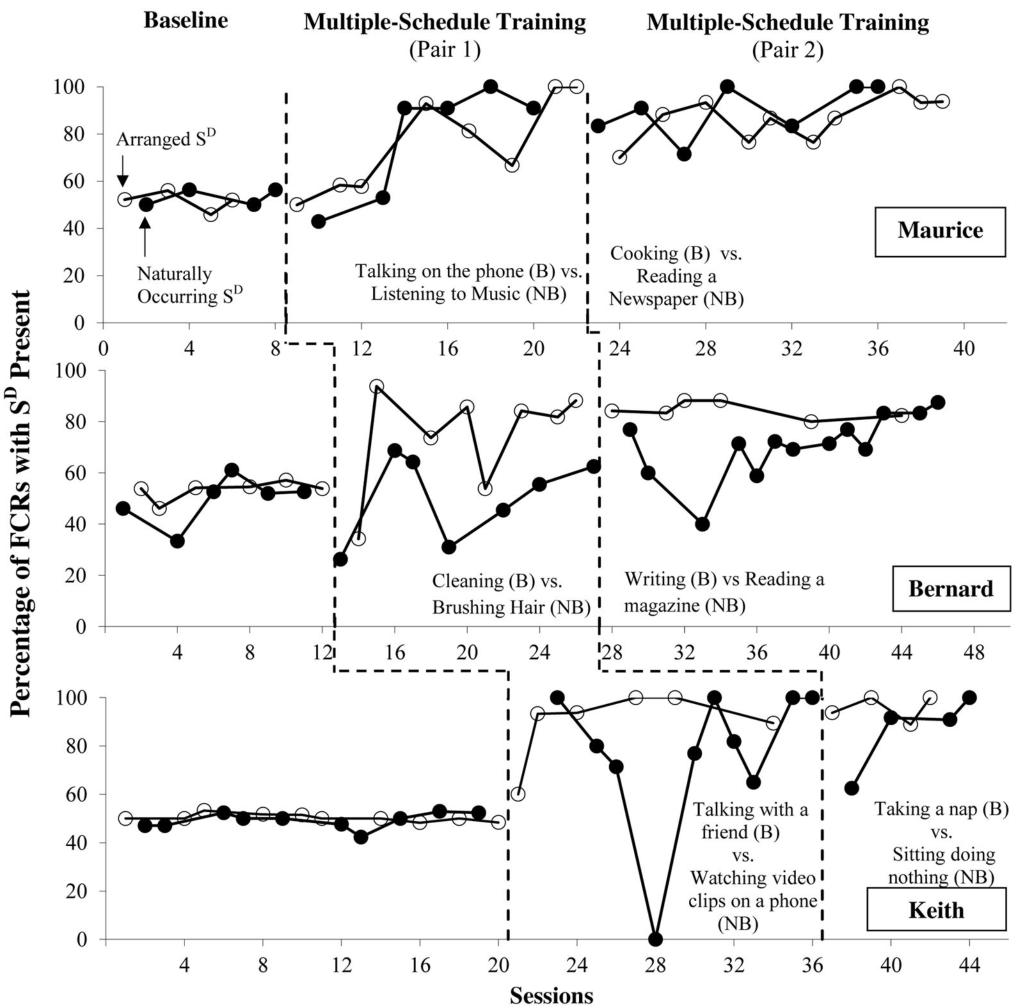

Figure 3.

Percentage of functional communication responses (FCRs) across participants when the S^D was present for busy (B) and nonbusy (NB) components of Pair 1 and Pair 2 activities during baseline and training with naturally occurring and arranged S^Ds for Maurice (top), Bernard (middle), and Keith (bottom).

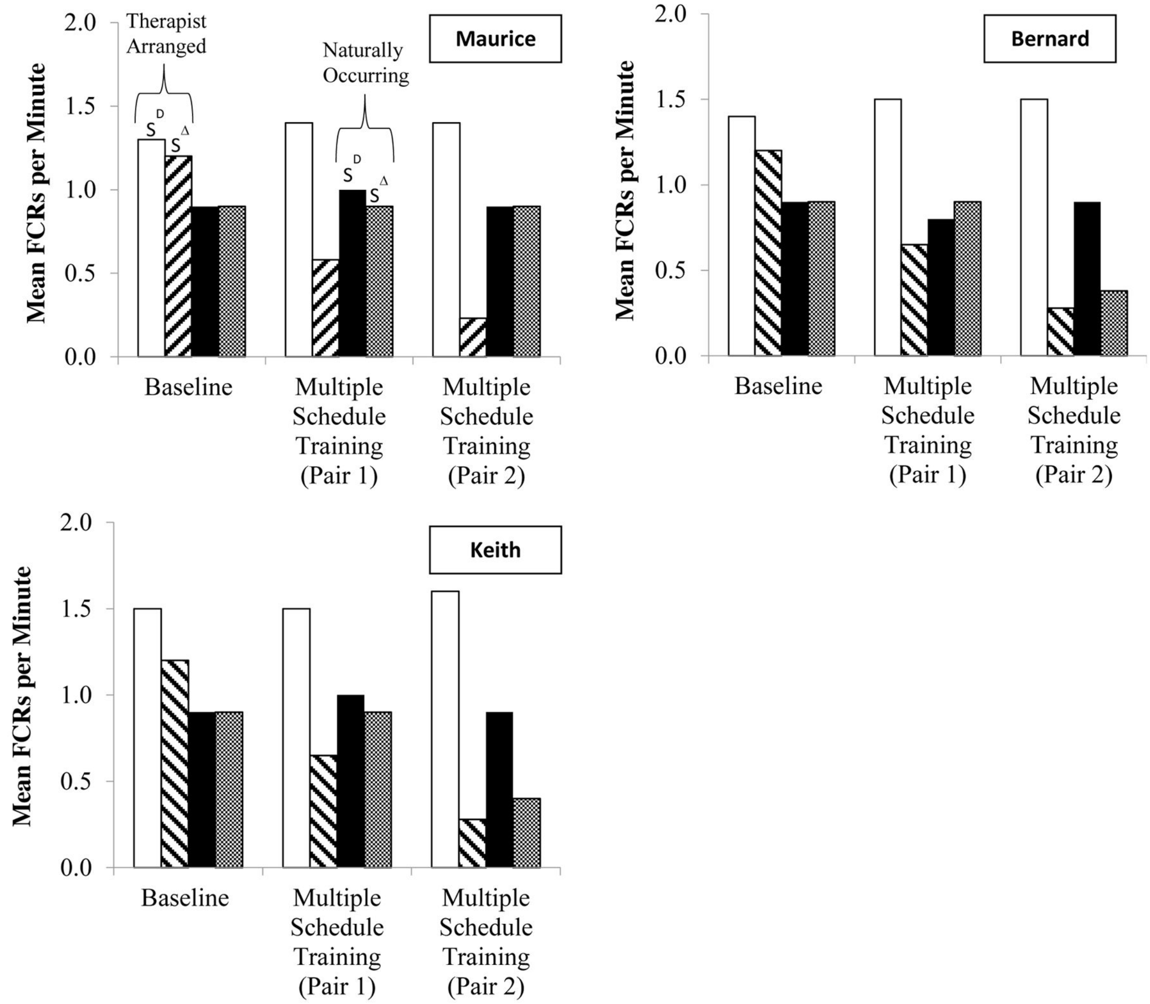

Figure 4.

Mean FCRs per minute for S^D and S^Δ components of therapist-arranged and naturally occurring conditions during baseline and multiple-schedule training (Pairs 1 and 2) in Experiment 1 for Maurice (top left), Bernard (top right), and Keith (bottom).

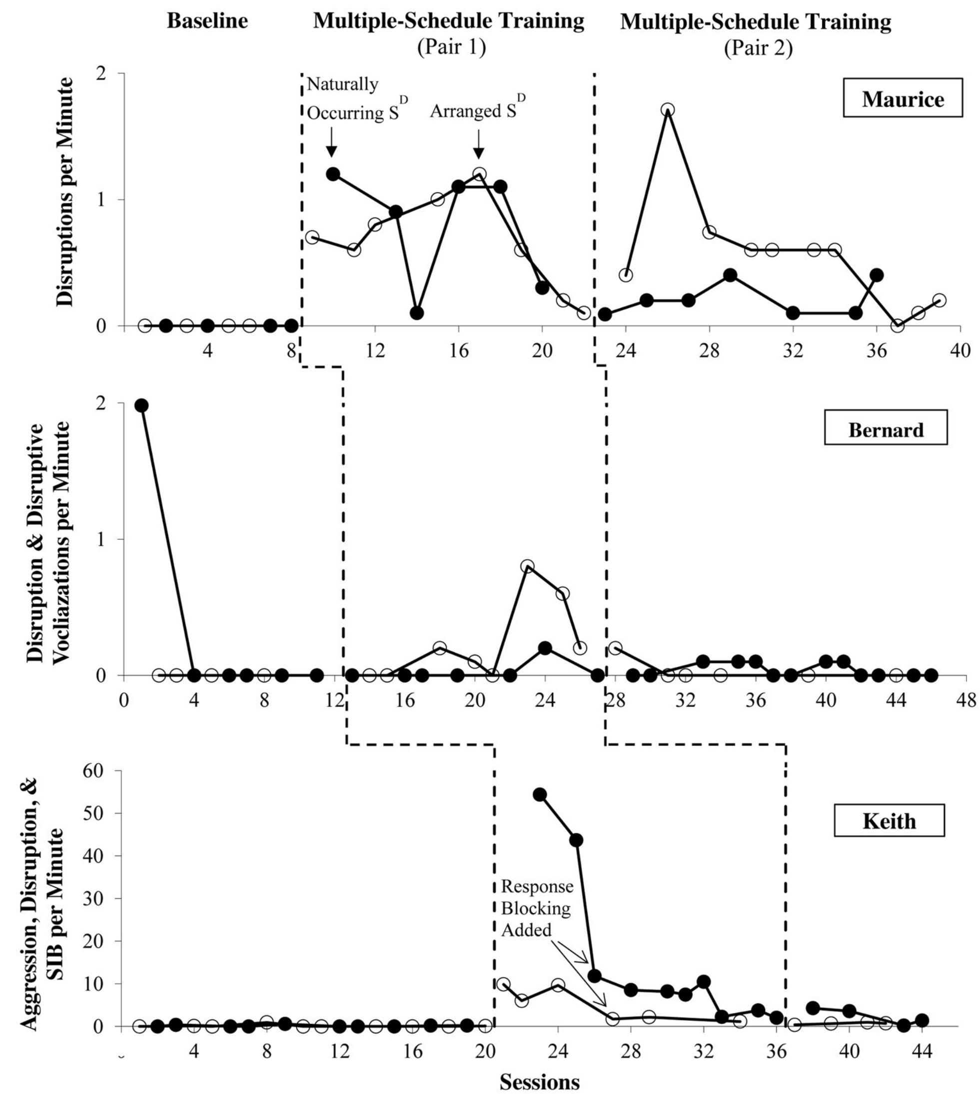

Figure 5.

Responses per minute of problem behavior across participants when the S^D was present for busy and nonbusy components of Pair 1 and Pair 2 activities during baseline and training with naturally occurring and arranged S^{D}s for Maurice (top), Bernard (middle), and Keith (bottom).

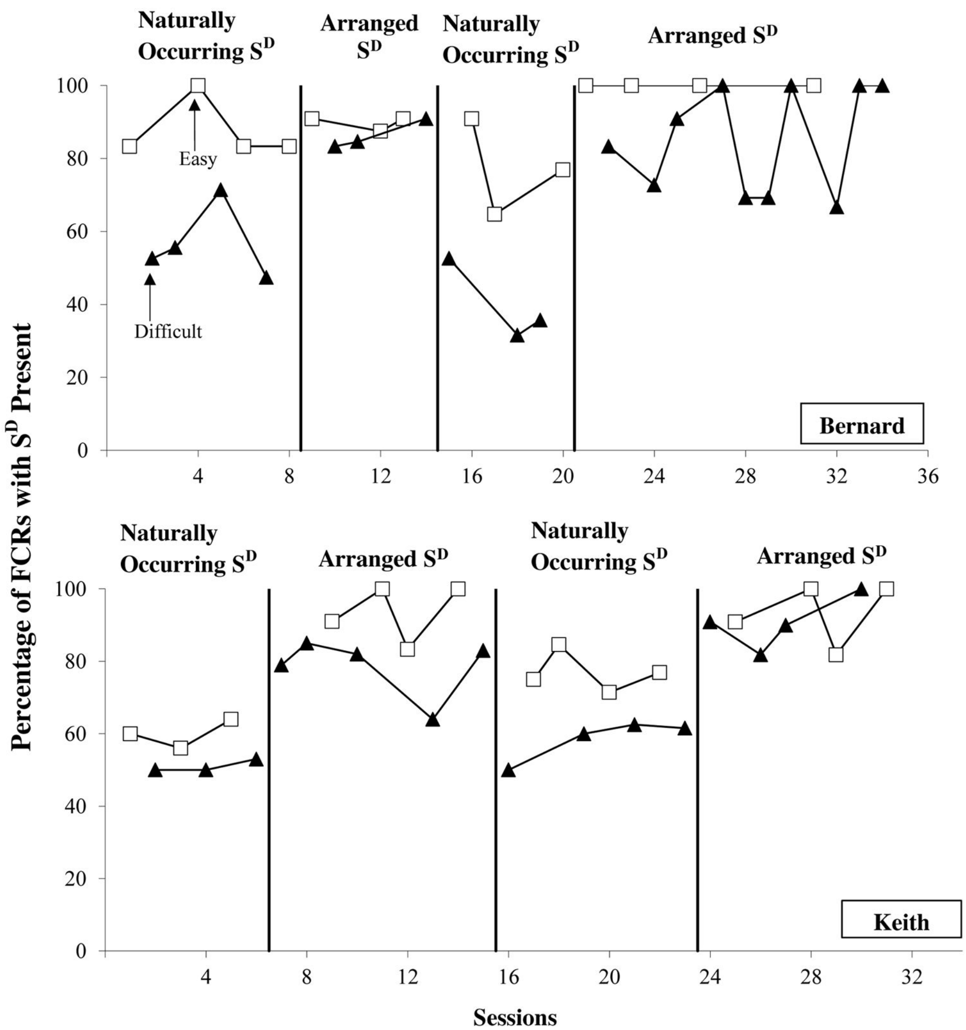

Figure 6.

Percentage of functional communication responses (FCRs) when the S^D was present for Bernard and Keith during posttraining generalization sessions for easy and difficult pairs of activities with naturally occurring and arranged S^Ds.

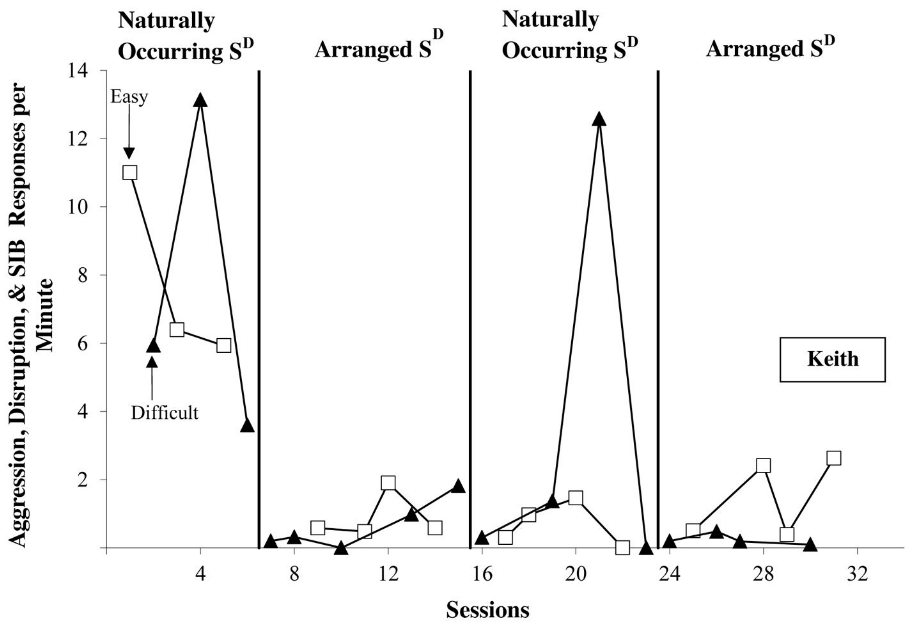

Figure 7.

Responses per minute of problem behavior for Keith during posttraining generalization sessions for easy and difficult pairs of activities with naturally occurring and arranged S^Ds.

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Table 1

Easy and Difficult Discrimination Pairs of Busy and Nonbusy Therapist Activities

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

Table 2

Easy and Difficult Discrimination Pairs of Busy and Nonbusy Therapist Activities Across Participants in Experiments 1 and 2

Participant	Easy	Difficult	Easy	Difficult
Bernard	Cleaning (B) or brushing hair (NB)	Writing (B) or reading a magazine (NB)	(Pair 1) Cooking (B) or sitting doing nothing (NB)	(Pair 1) Math assignment (B) or completing a Sudoku puzzle (NB)
			(Pair 2) Talking on the phone (B) or reading a newspaper (NB)	(Pair 2) Filing electronic taxes with laptop (B) or searching for entertainment news with laptop (NB)
Keith	Talking with a friend (B) or watching video clips on a phone (NB)	Taking a nap (B) or sitting and doing nothing (NB)	(Pair 1) Cleaning (B) or reading a magazine (NB)	(Pair 1) Studying or reading for an exam (B) or reading a fiction book (NB)
			(Pair 2) Talking on the phone (B) or listening to music (NB)	(Pair 2) Writing a resignation letter (B) or writing a thank you letter (NB)