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Transfer of treatment effects from combined to isolated conditions during functional communication training for multiply controlled problem behavior

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Abstract

Functional communication training (FCT) is highly effective for treating socially maintained problem behavior when based on the results of functional analyses (FA). Research suggests that combining relevant antecedents and consequences of problem behavior during FCT can be an efficient approach to treatment for behavior that is multiply controlled. However, no studies have evaluated whether treatment effects under combined conditions would transfer to single, or isolated, conditions. Participants were 5 children with autism, aged 3 years to 6 years, who engaged in problem behavior maintained by both escape from demands and access to tangibles. An experimenter coached their caregivers via video conferencing to implement FA and FCT in their homes. All participants received FCT under a combined condition, followed by brief exposure to sessions with isolated antecedents and consequences. Treatment effects for just 1 of the 5 participants immediately persisted under isolated conditions. These results suggest that, when caregivers combine variables relevant to multiple functions during FCT, exposure to isolated conditions may at least temporarily produce treatment failures.

Keywords

caregiver training; functional communication training; treatment relapse

Functional communication training (FCT) is a highly effective function-based treatment for problem behavior displayed by individuals with autism and other developmental disabilities (see Tiger, Hanley, & Bruzek, 2008, for a review). Treatment with FCT requires that therapists and caregivers first identify the reinforcer maintaining problem behavior (e.g., attention, escape from demands). Next, therapists and caregivers use the reinforcer to shape and maintain communication responses while withholding the reinforcer for problem behavior. For example, if a child's problem behavior is maintained by access to toys, FCT involves teaching the child to exhibit a communication response, or "mand" (e.g., sign, vocal statement, picture exchange), to gain access to the toy. Caregivers withhold access to the toy (i.e., implement extinction) when problem behavior occurs. If a child's problem behavior is maintained by escape from instructions, caregivers teach the child to request a break from demands while preventing escape for problem behavior.

Research findings suggest that FCT can produce rapid decreases in problem behavior and increases in mands, particularly when therapists and caregivers prompt and reinforce the communication response on a fairly dense schedule (Hagopian, Fisher, Sullivan, Acquistio, & LeBlanc, 1998). The rapid effects produced by FCT are particularly beneficial when treating severe problem behavior or when the therapist has limited time to provide services. For example, FCT is the most widely studied function-based treatment in research on telehealth services for families of children with autism and other developmental disabilities (e.g., Benson et al., 2018; Machalicek et al., 2016; Wacker et al., 2013b). FCT seems well-suited for telehealth services, as these services are typically provided within the context of short, weekly parent training sessions and are considered a cost-effective alternative to in-person training (Lindgren et al., 2016).

Although dense reinforcement schedules promote rapid treatment outcomes, therapists and caregivers typically thin the reinforcement schedule for the mand following initial treatment success to maintain these outcomes and increase the practicality of FCT. Schedule thinning can take a variety of forms (see Hagopian, Boelter, & Jarmolowicz, 2011, for a review). For example, one common way to thin the reinforcement schedule for responses that are maintained by escape from demands is to require the child to comply with a gradually increasing number of demands before providing opportunities for the child to request a break (e.g., Fisher et al., 1993; Lalli, Casey, & Kates, 1995). This method is called “demand fading” or “chained schedules.” For responding that is maintained by access to tangibles or attention, a common approach is to require the child to wait for longer periods of time following the onset of the establishing operation (EO; i.e., removal of the tangible or attention) before providing opportunities for the child to request the reinforcer (e.g., Wacker et al., 2013b). The therapist or caregiver often removes the communication materials (e.g., picture card or communication device) when the reinforcer is not available, a method called “response restriction” (Fisher, Greer, Quirim, & DeRosa, 2014). Research suggests that gradual schedule thinning is generally very effective.

Although FCT is typically designed to address a single function of problem behavior, results of research suggest that some children’s problem behavior is maintained by more than one reinforcer (e.g., Kurtz et al., 2003; Wacker et al., 2017). For example, in Wacker et al. (2017), 51% of the 90 children with completed functional analyses engaged in problem behavior that was multiply controlled (e.g., maintained by both escape from demands and access to tangible items). In such cases, therapists or caregivers might teach two different mands (e.g., a request for a tangible and a request for a break from demands) while manipulating the relevant EOs (e.g., tangible restriction; delivery of demands) during separate treatment sessions (e.g., Falcomata, Wacker, Ringdahl, Vinquist, & Dutt, 2013; Hagopian et al., 1998).

In some studies, experimenters used a single, combined FCT condition for multiply controlled problem behavior to increase the efficiency and effectiveness of treatment (e.g., Berg, Wacker, Harding, Ganzer, & Barretto, 2007; Falcomata, White, Muething, & Fragale, 2012; Mitteer, Fisher, Briggs, Greer, & Hardee, 2019). In lieu of manipulating a single antecedent (e.g., removing a toy) and reinforcing a specific, relevant mand (e.g., “toy please”) during each treatment session, experimenters manipulated multiple antecedents

simultaneously while prompting and reinforcing a single, more general response (sometimes referred to as an “omnibus” mand; Hanley, Jin, Vanselow, & Hanratty, 2014). For example, Wacker et al. (2013b) and Suess et al. (2014) implemented a combined FCT condition for children whose problem behavior was maintained by escape from demands and access to tangible items. Therapists instructed the caregivers to (a) start each session by removing toys and delivering a demand, (b) prompt a response that would be relevant to both reinforcers (e.g., “play please”), and (c) provide escape from the demand and access to the toys contingent on the mand. Following brief access to the reinforcers, caregivers again removed the toys and delivered a demand. In a similar manner, Slaton, Hanley, and Raftery (2017) described the use of combined, or synthesized, FCT conditions after implementing a variant of functional analysis called the interview-informed synthesized contingency analysis. For example, the therapist removed attention and music while simultaneously delivering a demand, prompted the participant to say, “My way please,” and then provided access to music, attention, and escape contingent on the mand.

Treatment was highly effective in reducing problem behavior and increasing communication responses in all studies using combined FCT conditions. However, no studies evaluated treatment outcomes under isolated, or single, FCT conditions following treatment with the combined conditions. As such, the extent to which treatment effects would generalize to situations with isolated antecedents and consequences is unclear. Consideration of this issue seems warranted because the relevant antecedents for multiply controlled problem behavior are unlikely to occur exclusively in combination. For example, it seems likely that caregivers may at least occasionally restrict access to a toy without delivering a demand and vice versa.

Combined conditions during FCT might establish restricted stimulus control, leading to decreases in communication responses, increases in problem behavior, or both, under isolated FCT conditions. For example, although toy removal and demand delivery function as EOs for responses that produce access to the maintaining reinforcers, it is possible that they could also acquire discriminative properties if caregivers never prompt the communication responses under isolated EO conditions (e.g., when caregivers remove a toy without delivering a demand). Potential difficulties with the transfer of stimulus control from combined to isolated conditions is consistent with basic and applied research on compound stimuli and overselectivity (e.g., Reed, Broomfield, McHugh, McCausland, & Leader, 2009; Wilkie & Masson, 1976).

In a similar manner, when caregivers successfully thin the schedule under combined conditions, they may not observe similar outcomes when they implement the same terminal schedule under isolated conditions. For example, when caregivers combine schedule thinning for positive and negative reinforcement, they may require the child to comply with an increasing number of demands before providing opportunities to request a break with toys. As such, the caregiver is combining a delay to the positive reinforcer with a work requirement. When a caregiver then removes toys in isolation, the child will not encounter demands while waiting for opportunities to request the positive reinforcer. The difference between the isolated and combined conditions may be sufficient to hinder immediate transfer of stimulus control for some individuals. Moreover, results of research on self-control suggest that combining delays to positive reinforcement with a work requirement

may increase the likelihood of successful schedule thinning (e.g., Dixon & Cummings, 2001).

For these reasons, exposure to isolated conditions following either initial treatment with FCT or successful thinning to a desired terminal schedule may result in at least temporary decreases in communication responses, increases in problem behavior, or both. Therapists and caregivers may prevent or remediate treatment relapses by implementing treatment or schedule thinning under both isolated and combined conditions. However, to determine if therapists should recommend such an approach, research is needed on the generality of FCT outcomes under isolated conditions following treatment under combined conditions.

In this study, caregivers of children with autism who engaged in problem behavior that was maintained by both escape from demands and access to tangibles implemented FCT under combined conditions. Therapists coached the parents to conduct functional analyses and FCT via weekly telehealth appointments. Following successful initial treatment with FCT, caregivers probed treatment under isolated conditions and, if necessary, implemented additional treatment sessions under one or both isolated conditions. Some caregivers also again probed treatment under isolated conditions following successful schedule thinning under combined conditions.

METHOD

Participants and Settings

Five children and their caregivers participated. The children included four boys and one girl between the ages of 3 and 6 years. The mothers of the children conducted all of the sessions. All families were participating in a larger research project on the delivery of assessment and treatment services via telehealth technologies. To be eligible for this study, the child had to be at least 2 years old, diagnosed with autism spectrum disorder as indicated by the results of the Autism Diagnostic Observation Schedule-2nd Edition (Lord, Luyster, Gotham, & Guthrie, 2012) and Autism Diagnostic Interview-Revised (Rutter, Le Couteur, & Lord, C., 2003) administered by trained professionals immediately prior to their enrollment in the study, and receive a score of 12 or higher on the Aberrant Behavior Checklist (Aman & Singh, 1986). In addition, results of a pretreatment FA had to indicate that problem behavior was maintained by both escape from demands and access to tangibles. Furthermore, caregivers had to indicate that they wanted to target both functions and that they wanted to use a combined intervention approach. Trained professionals also administered intellectual assessments with all children immediately prior to their enrollment in the study. Neil, age 3 years, received a score of 62 on the Stanford-Binet Intelligence Scale (Thorndike, 1986); Yancey, age 5 years, received an early learning composite score of 49 on the Mullen Scales of Early Learning (Mullen, 1995); Donny, age 5 years, received a score of 93 on the Wechsler Preschool and Primary Scale of Intelligence, 4th Edition (WPPSI-IV; Wechsler, 2012); Sandy, age 6 years, received a score of 80 on the WPPSI-IV; and Jeff, age 6 years, received a score of 73 on the WPPSI-IV. A Board certified Behavior Analyst with 5 years of experience working with children with autism coached the caregivers to implement all study procedures.

The experimenter conducted all sessions in an office on the grounds of a university. All families were located in their homes. Caregivers conducted sessions in the child's playroom (Neil), bedroom (Yancey), parents' bedroom (Donny), game room (Sandy), or kitchen (Jeff).

Response Measurement, Procedural Integrity, and Reliability

Problem behavior included screaming (all participants), defined as vocalizations above conversation level; aggression (all participants except Sandy), defined as the hands or other body parts forcefully coming into contact with the parent's face and body, pinching others, or pushing others; spitting (Sandy), defined as opening lips and making a spitting sound; and property destruction (all participants except Donny), defined as throwing and hitting objects. Independent mands were defined as touching a communication card, handing the parent a communication card, touching a Proloquo software icon on an iPhone screen (Yancey only), or emitting the vocal response "play please," without gesture, model, or physical prompts and without engaging in any targeted problem behavior during that trial. All children were taught to touch or exchange a communication card or icon containing the text "play please," but they also received reinforcement if they emitted the vocal response. Trained observers collected data via laptop computers using frequency (Sandy only) or 10-s partial interval recording for problem behavior and frequency recording for independent mands. Data on problem behavior were converted to responses per minute or percentage of intervals scored, and data on independent mands were converted to a percentage of trials. The parent's arranging the relevant antecedent (i.e., delivering a demand, removing a tangible) was considered the beginning of a trial, and the parent's delivery of the functional reinforcer (i.e., escape, access to the tangible) was considered the end of the trial.

Observers also collected data on parents' procedural integrity during at least 30% of FA sessions and FCT sessions and 100% of isolated test sessions. The data were calculated by dividing the number of correct antecedents and consequences by the total number of opportunities and converting the result to a percentage. Mean procedural integrity for Neil's parent was 74% (range, 63% – 100%) for the FA, 95% (range, 86% – 100%) for the FCT sessions, 98% (range, 93% – 100%) for the isolated demand test sessions, and 91% (range, 71% – 100%) for the isolated tangible test sessions. Mean procedural integrity for Yancey's parent was 96% (range, 82% – 100%) for the FA, 99% (range, 91% – 100%) for the FCT sessions, and 100% for the isolated demand and isolated tangible test sessions. Mean procedural integrity for Donny's parent was 99% (range, 92% – 100%) for the FA and 100% for the FCT, isolated demand test, and isolated tangible test sessions. Mean procedural integrity for Sandy's parent was 100% for the FA, FCT, and isolated test sessions. Mean procedural integrity for Jeff's parent was 100% for the FA, 98% (range, 75% – 100%) for the FCT sessions, 93% (range, 75% – 100%) for the isolated demand test sessions, and 100% for the isolated tangible test sessions.

Secondary observers independently scored at least 30% of the sessions in each condition. We divided sessions into consecutive 10-s intervals for the purpose of calculating interobserver agreement. We calculated IOA for all dependent variables by dividing the number of intervals for which both observers agreed on the number of responses, by the number of intervals for which both observers agreed and disagreed on the number

of responses, and converting to a percentage. Interobserver agreement data for problem behavior during the FA and FCT sessions were collected for 48% and 44% of sessions, respectively, and averaged 94% (range, 73% to 100%) and 98% (range, 73% to 100%), respectively, across the participants. Interobserver agreement data for independent mands during FCT sessions were collected for 33% of sessions and averaged 98% (range, 87% to 100%) across the participants. Interobserver agreement data for parents' procedural integrity during the FA and FCT sessions were collected for 38% and 30% of sessions, respectively, and averaged 99% (range, 97% to 100%) and 99% (range, 86% to 100%), respectively, across the participants.

Software and Hardware

The therapist used Vidyo, a HIPAA-compliant video conferencing software, and a desktop computer with a 34" screen connected to an Ethernet cable to conduct the telehealth sessions. Four parents used laptop computers with wireless internet connection to participate in the sessions. One parent used a smart phone with wireless internet connection. Prior to each appointment, the experimenter sent an e-mail message containing a connection link generated by the Vidyo software to the parent. The parent clicked on the video link to initiate a telehealth session and communicated with the experimenter via Vidyo software and the camera on the laptop or smart phone. The experimenter recorded all sessions via Debut software for later data scoring and analysis.

Procedures and Experimental Design

The experimenter conducted sessions once per week during 1-hr appointments. All FA and FCT sessions lasted 5 min. During the first appointment, the experimenter and caregiver identified topographies of problem behavior, developed operational definitions, and discussed the conditions under which the targeted problem behavior occurred. The experimenter used this information to individualize the conditions of the FA (e.g., select the instructions for the demand condition, identify the items to include in the tangible condition). In the second appointment, the experimenter described the purpose of the FA and the caregiver's role in each condition. The parent implemented all FA and FCT sessions with remote coaching from the experimenter as described by Suess et al. (2014).

The effects of FCT on problem behavior and independent mands were examined via a multiple baseline design across participants. For each participant, we used a reversal design to examine the effects of isolating the FCT conditions following treatment under combined conditions. However, the sequence of conditions during FCT (described below) varied somewhat across participants. All parents implemented combined FCT sessions following baseline. Once child behavior met a criterion, all parents implemented isolated test sessions. If problem behavior remained low and communication remained high in the isolated test sessions, the parent implemented combined FCT schedule thinning sessions, followed by additional isolated test sessions in the final phase. This latter sequence of conditions occurred for just one of the five participants (Sandy). The remaining four parents implemented additional combined FCT sessions, followed by another set of isolated test sessions, because treatment effects did not continue under one or both of the isolated conditions in the first set of test sessions. Three of these parents (those for Neil, Yancey,

and Donny) then implemented isolated FCT and schedule thinning sessions in the final phase. For the remaining parent (Jeff's parent), we evaluated responding under isolated test sessions following combined FCT schedule thinning. This parent then implemented isolated FCT and schedule thinning in the final phase.

Baseline.—The FA sessions served as the initial baseline for all participants. Parents conducted the sessions similarly to the method described by Wacker et al. (2013a). Conditions included attention, tangible, demand, and play, alternated in a multielement design. The families were participating in a larger research project that required the parent to implement a brief extinction baseline following the FA. Thus, the parent also exposed problem behavior to extinction alone prior to implementing FCT. These sessions were identical to the tangible and demand sessions of the FA except that the experimenter instructed the parents to withhold the tangible regardless of problem behavior during the tangible condition and to use three-step prompting contingent on noncompliance or problem behavior during the demand condition. The tangible items were a car toy (Neil), Playdoh (Yancey), video games (Donny), and iPhone or iPad (Donny, Sandy, Jeff).

Combined FCT.—Procedures were similar to those described by Suess et al. (2014). The experimenter instructed the mother (a) to sit next to the child at a desk with individualized task materials, the highly preferred item from the tangible condition of the FA, and a communication card or iPhone (for Yancey), (b) to remove the preferred item and present an instruction, (c) to use three-step prompting (i.e., vocal, gesture, physical prompts) contingent on child noncompliance or problem behavior, (d) to deliver praise plus prompts to touch or hand the parent the communication card or icon contingent on child compliance, and (e) to remove the materials and give the child access to the tangible item for 30 s contingent on mands. The caregiver was instructed to repeat this sequence (remove the item, deliver an instruction, prompt if needed, and reinforce the mand) at the end of each 30-s reinforcement interval. The parent faded the prompts for communication responses using a most-to-least prompt hierarchy. Treatment continued until the child engaged in no instances of problem behavior and exhibited independent mands on at least 100% of trials for at least two consecutive sessions.

Isolated test.—The parent implemented these test sessions following combined FCT (described above) and combined FCT schedule thinning (described below). The parent implemented two different test conditions. In the isolated demand test, the parent sat next to the child at a desk with individualized task materials and a communication card or iPhone (for Yancey), presented an instruction, used three-step prompting contingent on child noncompliance or problem behavior, delivered praise contingent on child compliance, and gave the child a 30-s break following mands. No preferred items were present in the room. The caregiver did not provide prompts for the communication response. In the isolated tangible test, the caregiver removed the preferred item at the beginning of each FCT session, provided access to the tangible for 30 s contingent on a correct mand, and did not provide access to the tangible contingent on problem behavior. The parent did not provide prompts for the communication response. In most cases, the parent implemented two sessions of each condition. It is important to note an important difference between the isolated demand and

tangible test conditions. The isolated demand test included two potential EOs because the caregiver not only presented instructions (EO for negative reinforcement) but removed the tangible item from the room that had been present during the combined FCT sessions (EO for positive reinforcement). Under this condition, we might see a reduction in mands and an increase in problem behavior due to problems with restricted stimulus control or because mands no longer produced access to tangible reinforcement during the break. On the other hand, a single EO occurred in the isolated tangible test because the caregiver did not present any instructions (an abolishing operation for negative reinforcement) while withholding the tangible reinforcer (EO for positive reinforcement). Under this condition, any reductions in mands and increases in problem behavior likely would be due to restricted stimulus control.

Isolated FCT and schedule thinning.—The parent implemented isolated FCT sessions if problem behavior increased or manding decreased during isolated tests. Procedures were identical to those in the isolated tests except that the parent provided prompts for the communication response as described in the combined FCT condition. The parent alternated these sessions with combined FCT sessions. The parent also gradually increased the amount of time that the child had to wait before requesting a tangible or the number of tasks that the child had to complete before requesting a break until the child reached a terminal goal chosen by the parent. The communication card or iPhone (for Yancey) was not available until the child had waited the required amount of time or completed the required number of tasks. The amount of time that the child had to wait before requesting a tangible in the tangible condition was yoked (i.e., matched) to the amount of time that it typically took the child to complete the designated number of tasks in the demand condition. The criterion for thinning the schedule was two consecutive sessions with no occurrences of problem behavior and with independent mands above 80% of opportunities.

Combined FCT schedule thinning.—Procedures were identical to those in the combined FCT condition, except that the parent gradually increased the number of tasks that the child had to complete before requesting a break, until the child reached a terminal goal chosen by the parent. Schedule thinning procedures were identical to those in the isolated FCT schedule thinning condition. The criterion to increase the number of tasks was two consecutive sessions with no occurrences of problem behavior and with independent mands above 80% of opportunities.

RESULTS

The percentage of intervals with problem behavior and percentage of trials with independent mands are shown in Figure 1 for the first three participants. Neil (top two panels) engaged in problem behavior during the tangible, demand, and attention conditions of the FA. Levels of problem behavior remained high when the parent implemented extinction in the tangible and demand conditions. Combined FCT produced gradual reductions in problem behavior with corresponding increases in independent mands. The first set of isolated demand test sessions was associated with immediate increases in problem behavior to baseline levels and reductions in independent mands, an outcome that was replicated during two additional isolated test phases. (We implemented the third set of isolated test sessions due to the variable levels of responding in the third phase of combined FCT.) Similar outcomes

occurred for the isolated tangible sessions. Neil engaged in no problem behavior and exhibited independent mands during 100% of trials with each reintroduction of combined FCT. Because treatment effects did not transfer to the isolated conditions, we introduced isolated FCT and scheduling thinning in the final phase. Problem behavior remained low and independent mands remained high, with a few exceptions, as we thinned the schedule to the terminal value (writing five letters in the demand condition and waiting 5 s in the tangible condition).

Yancey (middle two panels) engaged in problem behavior primarily in the tangible and demand conditions of the FA. Levels of problem behavior increased further during the extinction sessions. With the introduction of combined FCT, he engaged in no problem behavior and exhibited independent mands during 100% of trials by the third session. He continued to engage in no problem behavior and high levels of independent mands during the remaining isolated demand test sessions. However, the isolated tangible test sessions were associated with increases in problem behavior and decreases in independent mands across two additional test phases. Thus, we introduced isolated FCT and schedule thinning. Levels of problem behavior and independent mands were variable across the schedule thinning, but problem behavior eventually decreased to zero and independent mands increased to 100% of trials at the terminal schedule value (drawing four straight lines in the demand condition and waiting 4 s in the tangible condition).

Donny (bottom two panels) engaged in problem behavior primarily in the tangible and demand conditions of the FA. Levels of problem behavior increased further during the extinction sessions. Problem behavior immediately decreased to zero and independent mands gradually increased to 100% of trials with the introduction of combined FCT. The isolated demand test sessions were associated with increases in problem behavior and decreases in independent mands during the two isolated test phases. Similar outcomes occurred for the isolated tangible sessions. With each reintroduction of combined FCT, Donny again engaged in no problem behavior and exhibited independent mands during 100% of trials. Thus, the parent introduced isolated FCT and schedule thinning. Levels of responding were variable as the parent thinned the schedule. Under the terminal schedule value (writing 15 letters or completing 15 problems on a school worksheet in the demand condition and waiting 15 s in the tangible condition), Donny engaged in no problem behavior and emitted independent mands on 100% of trials in both conditions.

We evaluated responding in isolated tests sessions following combined FCT schedule thinning for the remaining two participants (Figure 2). Sandy (top two panels) engaged in problem behavior in the tangible and demand conditions of the FA. Levels of problem behavior increased further in each condition during extinction. The introduction of combined FCT was associated with a rapid reduction in problem behavior and an increase in independent mands. Sandy did not emit problem behavior and engaged in independent mands in 100% of trials during the isolated test sessions. Thus, we introduced combined FCT schedule thinning. Problem behavior remained low and independent mands remained high as the parent required Sandy to complete more tasks before requesting reinforcement until she reached the terminal schedule value (writing 10 letters). Problem behavior remained low and independent mands remained high when the parent reintroduced isolated

FCT tests at the final schedule value. The amount of time that Sandy was required to wait before requesting her tangible (150 s) was yoked to the amount of time that Sandy typically took to complete 10 letters.

Jeff (bottom panel) engaged in the highest levels of problem behavior in the tangible and demand conditions of the FA, and levels increased further in those conditions when the caregiver introduced extinction. Combined FCT produced a reduction in problem behavior to zero and an increase in independent mands to 100% of trials. Introduction of isolated test sessions corresponded with an increase in problem behavior and a decrease in independent mands for one session in the demand condition only. Problem behavior did not occur and independent mands occurred in 100% of trials when the parent reintroduced combined FCT. Treatment effects continued under the second set of isolated test sessions, so we introduced schedule thinning under combined FCT. Problem behavior remained at zero and independent mands remained high as the parent required Jeff to complete an increasing number of demands (writing 15 letters) before requesting a break with his tangible item. Problem behavior increased and independent mands decreased in both isolated tangible test sessions that followed the combined FCT schedule thinning, during which Jeff was required to wait 60 s before requesting his tangible (yoked to the amount of time that Jeff typically took to complete 15 letters). In the final phase, the parent implemented isolated FCT and schedule thinning in the tangible condition only during which problem behavior remained fairly low and independent mands remained at 100% as the wait time was gradually increased to 60 s.

Figure 3 shows the mean level of problem behavior and independent mands during the last three sessions of the combined FCT condition that preceded each isolated test and during all isolated demand and isolated tangible test sessions for each participant. Treatment effects under combined conditions transferred to isolated conditions for just one of five participants (Sandy). Results for the remaining four participants prior to schedule thinning showed increases in problem behavior and/or decreases in independent mands during both isolated demand and tangible conditions (Neil, Donny), during the isolated demand condition only (Jeff), and during the isolated tangible condition only (Yancey). Following schedule thinning, treatment effects did not transfer to the isolated tangible condition for one of two participants (Jeff). Child behavior may have been under the combined stimulus control of the demands, instructional materials, and tangible items during the combined condition. If so, this source of control may have been disrupted at least temporarily under the isolated conditions.

However, as noted previously, it is also possible that the EO for tangible reinforcement was present during the isolated demand test sessions. If so, problem behavior may have increased during these sessions because the child received a break without access to the tangible contingent on the mand. The mand would have been exposed to extinction for tangible reinforcement, potentially leading to extinction-induced resurgence of problem behavior (e.g., Volkert, Lerman, Call, & Trosclair-Lasserre, 2009). To evaluate this alternative explanation, we examined within-session patterns of responding during the isolated demand test sessions with increases in problem behavior. We calculated the percentage of demand trials with problem behavior and the percentage of break periods with problem behavior. Problem behavior should be much less likely to occur during breaks than during demand

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trials if only the EO for escape was present during the isolated demand test sessions (e.g., Roane, Lerman, Kelley, & Van Camp, 1999). On the other hand, problem behavior might occur during breaks if the EO for tangible reinforcement was in operation. Figure 4 displays results of this analysis for the three participants who demonstrated treatment decrements during one or more isolated demand test sessions. Problem behavior occurred during a substantial percentage of breaks for two of the participants and during a modest percentage of breaks for one participant. This suggests that the EO for tangible reinforcement may have been present in these sessions.

DISCUSSION

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We evaluated the effects of isolating the antecedents and consequences relevant to single behavioral functions after parents initiated FCT under combined conditions for children who engaged in multiply controlled problem behavior. Results for four of five children suggested that exposure to the isolated conditions disrupted treatment effects obtained under the combined condition. This disruption was equally likely to occur in the isolated demand and tangible conditions, with treatment effects at least temporarily failing to transfer to the isolated demand condition for three participants and to the isolated tangible condition for three participants.

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Numerous studies suggest that combining variables relevant to multiple functions may be an effective and efficient approach to treatment (e.g., Berg et al., 2007; Falcomata et al., 2012; Mitteer et al., 2019; Slaton et al., 2017; Suess et al., 2014; Wacker et al., 2013b). However, our findings indicate that problem behavior may increase, communication may decrease, or both when a child is taught an omnibus mand under combined conditions and then exposed to isolated conditions. This is an important consideration, as it seems likely that a child would at least occasionally experience isolated conditions following initial treatment under combined conditions. For example, a parent may remove a toy without presenting a demand or provide escape from demands without access to a toy. Caregivers may avoid even short-lived treatment decrements by implementing FCT under both combined and isolated conditions from the outset of treatment. It should be noted, however, that these results may only be relevant for children whose problem behavior is maintained by multiple isolated consequences, rather than by combined, or synthesized, consequences as reported in some studies (e.g., Slaton et al., 2017). The findings also may not generalize to problem behavior that is maintained by other combinations of social reinforcers, such as access to attention and tangibles. For example, results of the FA for Neil and Jeff indicated that their problem behavior also was maintained by attention. We did not address the attention function as part of treatment because their caregivers wanted to prioritize the escape and tangible functions. However, further research is needed to determine if treatment under combined FCT with two sources of positive reinforcement would transfer to isolated conditions.

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Furthermore, initially, we only briefly evaluated the effects of the isolated conditions on responding. We purposely limited exposure to the isolated conditions during our tests so that we could compare responding under isolated and combined conditions in a reversal design. We assumed that continued exposure to isolated FCT would effectively reduce problem behavior and increase communication responses to the levels obtained in the combined FCT.

Results of four participants' exposure to isolated FCT and schedule thinning in the final stage of treatment were consistent with this assumption. In addition, although responding was quite variable, we generally replicated the effects of transitioning from combined to isolated conditions for most of the participants. Responding during the isolated test sessions, however, indicated highly transient effects for Donny and Jeff, which complicates interpretation of their data. Nonetheless, Jeff's problem behavior also emerged when we reintroduced isolated test sessions following combined FCT with schedule thinning. Further research is needed to determine the extent and durability of this clinical concern given the limited exposure to isolated tests in this study.

The mechanism(s) underlying the effects also are not clear. We hypothesized that combining conditions during treatment with FCT might establish restricted stimulus control, leading to decreases in communication responses, increases in problem behavior, or both, under the isolated FCT conditions. However, one limitation of the study was that the EO for tangible reinforcement may have been present during the isolated demand test sessions. If so, increases in problem behavior during these sessions might have occurred because the communication response contacted extinction for tangible reinforcement (i.e., the child received a break but not access to the tangible contingent on the communication response).

Our additional analysis of within-session patterns of responding suggests that issues related to response resurgence during extinction (e.g., Volkert et al., 2009) rather than to restricted stimulus control provide an alternative explanation for treatment decrements in the isolated demand test sessions for three participants. In future studies, experimenters might explore this potential mechanism by providing noncontingent access to the tangible during the isolated demand tests sessions. This approach, however, would introduce additional interpretative complications, as the presence of the tangible per se might function as a discriminative stimulus for the communication response. An alternative approach might be to provide access to the tangible for an extended period of time prior to demand sessions and then to remove the tangible from the room.

Extinction effects were unlikely to be relevant for the isolated tangible test sessions because the caregiver withheld all demands. As such, the most parsimonious explanation is that responding did not generalize from an FCT condition with demands and instructional materials (combined FCT) to a condition without those stimuli (isolated tangible). Furthermore, data on parent procedural integrity suggest that a reduction in integrity during the isolated tests is not a likely explanation for the findings. Regardless of the mechanism, results have important clinical implications as children are likely to experience isolated conditions (isolated antecedents, isolated consequences, or both) following treatment with combined conditions.

All of the children's problem behavior was initially exposed to an extinction-alone baseline due to their participation in another project. This also raises some interesting questions regarding the impact of this exposure on the outcomes of the isolated test sessions. It should be noted, however, that Sandy's outcomes suggested immediate generalization across combined and isolated conditions despite the fact that she experienced the extinction-alone baseline. Another limitation is that we examined the transfer of treatment effects to isolated

conditions following schedule thinning with combined conditions for just two of the five participants. Furthermore, the reinforcement schedules remained fairly dense for all participants due to their young ages and the terminal goal selected by their caregivers. Obtaining data on the acceptability of the combined versus isolated conditions for the participating caregivers also would have been informative.

The field would benefit from further research on the generality of treatment effects under single, or isolated, FCT conditions following treatment with combined FCT conditions. Although combining relevant antecedents and consequences of multiply controlled problem behavior provides an efficient approach to FCT, these findings suggest a potential limitation of this strategy. Exposing the child to isolated and combined conditions from the outset of FCT is a relatively straightforward solution to this problem. However, this would seriously compromise the efficiency of treatment. On the other hand, the generality of treatment effects under both isolated and combined conditions is important if the relevant antecedents and consequences of problem behavior occur both singly and in combination in the natural environment. As such, future research also might examine the transfer of treatment effects from isolated FCT to combined FCT. Ultimately, the field would benefit from further research on ways to improve both the durability and efficiency of treatments for problem behavior.

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Figure 1.

Percentage of 10-s intervals with problem behavior (top panels) and percentage of trials with independent mandants (bottom panels) across the functional analysis, extinction (EXT) baseline, combined functional communication training (C-FCT), isolated test sessions (T), and isolated FCT sessions for Neil, Yancey, and Donny.

Figure 2.

Responses per minute or percentage of 10-s intervals with problem behavior (top panels) and percentage of trials with independent mands (bottom panels) across the functional analysis, extinction (EXT) baseline, combined functional communication training (C-FCT), isolated test sessions (T), and isolated FCT sessions for Sandy and Jeff.

Figure 3.

Mean percentage of intervals with problem behavior and mean percentage of trials with independent mands during the last three sessions of the combined functional communication (FCT) condition that preceded each isolated test condition, all of the isolated demand test sessions, and all of the isolated tangible test sessions for each participant.

Figure 4. Percentage of demand trials and breaks with problem behavior during isolated demand test sessions with problem behavior for Neil, Donny and Jeff.