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An Assessment of Treatment Options for Pre-existing Prompt Dependence in Children with Developmental Disabilities

Ella Gorgan

University of Wisconsin-Milwaukee

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ASSESSING TREATMENT OPTIONS FOR PRE-EXISTING PROMPT DEPENDENCE IN
CHILDREN WITH DEVELOPMENTAL DISABILITIES

by

Ella M. Gorgan

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ABSTRACT

ASSESSING TREATMENT OPTIONS FOR PRE-EXISTING PROMPT DEPENDENCE IN CHILDREN WITH DEVELOPMENTAL DISABILITIES

by

Ella M. Gorgan

The University of Wisconsin – Milwaukee, 2017
Under the Supervision of Professor Tiffany Kodak

Prior research has focused on identifying effective strategies to prevent prompt dependence from occurring during the training of novel skills. This has been targeted in a variety of ways, including differential reinforcement, prompt fading, and allowing extended response intervals. Current literature has also indicated that the relative efficacy and efficiency of different prompting procedures may be idiosyncratic across learners, suggesting the potential benefit of an individualized assessment. The purpose of the current study was to extend the literature on prompt dependence by comparing interventions for skills for which four participants with developmental disabilities consistently engaged in correct responses following prompts but did not perform independently. This was done using an assessment-based strategy that compared the efficacy and efficiency of differential reinforcement, prompt fading, and extended response interval interventions. The intervention that led to skill mastery first was considered the most efficient procedure for each participant. Results were idiosyncratic across participants, indicating that the most efficacious and efficient intervention for prompt dependence must be determined via assessment-based intervention strategies.

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It is common practice in the field of applied behavior analysis to use prompts and prompt-fading strategies to teach novel skills to individuals with developmental disabilities because these techniques effectively minimize errors during instruction and lead to acquisition (Fisher, Kodak, & Moore, 2007; Oppenheimer, Saunders, & Spradlin, 1993; Seaver & Bourrett, 2014). There are several prompt-fading strategies that are effective for individuals with developmental disabilities and autism spectrum disorder (ASD), and these strategies may include different types of prompts. For example, least-to-most prompting is a prompt-fading strategy that begins an instructional opportunity with a less intrusive prompt (e.g., verbal prompt). More intrusive prompts (e.g., model and physical prompts) are added until the individual engages in the targeted skill.

Seaver and Bourrett (2014) compared the efficacy and efficiency of prompts and prompt-fading strategies on skill acquisition. They conducted three experiments to assess different types of prompts and prompt-fading procedures with 10 participants attending a school for individuals with autism and special needs. In all three experiments, the participants learned to build block structures. The results of the first two experiments showed that the most efficient prompt and prompt-fading strategy differed across participants. Thus, the efficacy of intervention procedures may be idiosyncratic, which is consistent with the results of other studies that compared skill-acquisition procedures (Kodak, Clements, & LeBlanc, 2013; Lermann, Vorndran, Addison, & Kuhn, 2004; Libby, Weiss, Bancroft, & Ahearn, 2008; Walls, Ellis, Zane, & VanderPoel, 1979) and suggests the need for assessments that identify the most efficient and efficacious procedure for each individual.

Although prompts are successful in occasioning correct responding during instruction, problems with prompt dependence may occur for some learners, and a transfer of stimulus

control from the prompt to the discriminative stimulus may be hindered (Clark & Green, 2004). Oppenheimer et al. (1993) defined prompt dependence as the participant consistently failing to engage in a response prior to the prompt despite having learned the skill. For certain individuals, attempts to fade a prompt and bring responding under the control of a naturally occurring discriminative stimulus may be unsuccessful, and correct responses are only emitted when the controlling prompt is presented (Cividini-Motta & Ahearn, 2013). For example, a child may only mand for milk when an adult asks, “What do you want?” Although the adult’s vocal prompt does not specify a response that will produce reinforcement, the child’s mand occurs in the presence of this vocal prompt rather than being under the control of a relevant establishing operation. McClannahan and Krantz (1999) say that during instruction that includes prompts, “Passive waiting is one of the responses that is repeatedly rewarded. This may explain why many children with autism who have learned to talk and do many useful activities do not speak or engage in familiar tasks unless instructed to do so” (p. 37). If prompt dependence cannot be resolved, it is unlikely that the child will ever truly achieve independence with these skills.

Previous research has used several strategies to prevent prompt dependence while learning a new skill or behavior chain. Most often, differential reinforcement has been used to proactively address prompt dependence while teaching new skills (Cividini-Motta & Ahearn, 2013; Hausman, Ingvarsson, & Kahng, 2014; Karsten & Carr, 2009). For example, Karsten and Carr (2009) compared the effects of different qualities of reinforcement for independent and prompted correct responses on skill acquisition for two participants diagnosed with autism. In the differential reinforcement condition, a lower-quality consequence (praise alone) was delivered contingent on prompted correct responses, and a higher-quality consequence (praise and an edible) was delivered for independent correct responses. In the non-differential reinforcement

condition, praise and an edible were delivered contingent on independent and prompted correct responses. The results showed that the differential reinforcement condition was more effective for teaching novel stimuli.

Cividini-Motta and Ahearn (2013) extended Karsten and Carr (2009) by evaluating the type of differential reinforcement necessary to produce mastery in participants with a history of prompt dependence. Four individuals with ASD who displayed prompt dependence based on caregiver report and performance on a matching-to-sample discrimination in which the participant waited for the prompt on at least 80% of the trials participated. The authors compared the effect of no differential reinforcement, high-preference reinforcers versus moderate-preference reinforcers, and high-preference reinforcers versus extinction on acquisition. In the no differential reinforcement condition, a high-preference reinforcer, based on the results of a preference assessment, was delivered contingent on both independent and prompted correct responses. In the high/moderate-preference reinforcer condition, independent correct responses produced the high-preference reinforcer and prompted correct responses produced a moderately preferred reinforcer. In the high-preference reinforcer/extinction condition independent correct responses produced the high-preference reinforcer, and prompted correct responses were placed on extinction. The results showed that none of the participants acquired the targeted skill in the no differential reinforcement condition. The high/moderate-preference reinforcer condition was the most efficacious intervention for three of four participants. The high-preference reinforcer/extinction condition was the most efficacious intervention for one participant. These results suggest that differential reinforcement that favors independent responding can facilitate acquisition of discrimination tasks and decrease prompt dependence, but the most effective arrangement may differ across learners.

Another intervention that has been proven to decrease prompt dependence during training of behavior chains is prompt fading. Prompt-fading strategies attempt to gradually remove the controlling prompt and transfer control to the naturally occurring discriminative stimuli. Bourret, Vollmer, and Rapp (2004) assessed procedures for teaching mands to children with developmental disabilities and deficient verbal repertoires. One of their participants engaged in the target mand only following a non-specific prompt (e.g., “If you want this, ask me for it.”), which showed prompt dependence. They implemented a prompt-fading procedure in which the non-specific prompt was gradually faded across phases. This strategy attempted to weaken the control exerted by prompts over the target response. The participant consistently engaged in two independent mands following prompt fading. These results showed that prompt fading effectively resolved prompt dependence in the context of teaching novel mands.

A third intervention that may be used to treat prompt dependence is an unlimited delay to prompts (i.e., waiting for an extended period of time for an independent response). Walls, Dowler, Haight, and Zawlocki (1984) compared progressive-delay procedures and unlimited-delay prompting procedures in forward chaining and whole-task training strategies for assembly tasks. There were four conditions, with each condition assigned to a different apparatus for assembly. In the whole task – unlimited delay condition, the experimenter modeled the assembly of the apparatus once and allowed the participant to imitate each step in the assembly task. Thereafter, the experimenter provided an instruction to “go ahead and put it together” with prompts provided only following an error. Participants were given as much time as necessary to complete the task. During the whole task – progressive delay condition, the experimenter modeled the first assembly, and all subsequent trials included a pre-response prompt progressively delayed by 1 s. During the forward chaining – unlimited delay condition, the

experimenter modeled a step of the assembly task and then provided an opportunity for the participant to engage in that step with an unlimited delay to the prompt. Successive steps were then added to the chain in subsequent sessions, following correct responding. During the forward chaining – progressive delay condition, the experimenter first modeled a step, and then provided an opportunity for the participant to respond. A 1-s delay was added for each additional trial per step as in the whole task – progressive delay condition. They found that the unlimited delay conditions resulted in the most errors; nevertheless, the unlimited delay conditions required the least amount of training time. Both whole-task procedures required more prompts than the forward chaining procedures, although both forward chaining procedures required more training time overall. Although increased errors during instruction is not ideal, Walls et al. (1984) included novel tasks in their study. It remains unclear whether use of an unlimited prompt delay (i.e., an extended response interval) during tasks for which the participant displays prompt dependence will produce similar outcomes.

The extant literature on interventions for prompt dependence describes strategies that can be used to prevent prompt dependence from occurring during training of novel skills (e.g., Cividini-Motta & Ahearn, 2013; Karsten & Carr, 2009). To our knowledge, only one study has examined procedures that can be used to treat prompt dependence once it has developed during training (Bourret et al., 2004), and this study included only one individual who engaged in prompt dependent behavior. Although the proactive approaches to preventing prompt dependence in the literature are helpful, there are individuals that have a prolonged history of prompt dependence who may not benefit from these kinds of intervention. In addition, it remains unclear whether the most effective intervention for prompt dependence will be consistent across participants or if intervention outcomes will be idiosyncratic, as suggested by the literature on

treatment comparisons for skill acquisition (e.g., Seaver & Bourret, 2014).

The purpose of the current study was to extend the literature on prompt dependence by comparing interventions for skills for which the participant consistently engaged in correct responses following prompts but did not perform independently. Because we anticipated that the most effective intervention may differ across participants, we used the methodology described in assessment-based instruction (e.g., Kodak et al., 2013; McGhan & Lerman, 2013) to compare interventions. Thus, the second purpose of the study was to apply assessment-based instruction to a comparison of interventions for prompt dependence to identify the most effective and efficient prompt-dependence intervention for each participant. We compared three interventions from the literature including differential reinforcement, prompt fading, and an extended response interval.

METHOD

Participants

Participants were four children, aged four to 16, with a diagnosis of ASD or a developmental disability. All participants had a history of prompt dependence, based on parent report. Parents nominated tasks for which the participant required frequent prompts to complete. If the participant required a prompt to complete the task during at least 80% of the response opportunities across two consecutive sessions of the prompt-dependence assessment, the participant met the inclusion criteria for the study. If the prompt-dependence assessment data showed that the participant independently and correctly responded without a prompt during 20% or more of response opportunities, the participant was excluded from the study (Cividini-Motta & Ahearn, 2013).

Ralph was a 16-year-old boy, diagnosed with a cognitive delay, Reactive Attachment Disorder, Oppositional Defiant Disorder, and a mood disorder, NOS. He was referred by his parents for being prompt dependent with personal care and daily living skills, including doing his laundry and making food for himself. Ralph's caregivers frequently provided vocal prompts in the home environment. The particular vocal prompts used by Ralph's parents were non-specific prompts, such as "What do you want?" or "What's up, Ralph?" Ralph used short phrases to describe items in his environment and acquired a few intraverbals (e.g., responses to social questions) during his intervention services, but often demonstrated prompt dependence when making requests for preferred items or activities (e.g. asking to play with his remote-control truck).

Benny was a 14-year-old boy with an ASD diagnosis. He was referred by his parents for being prompt dependent in many areas, including asking for preferred items, describing items in his environment, and personal hygiene tasks (e.g. hand washing, tooth brushing). Benny's caregivers also provided frequent non-specific prompts at home (e.g., "What do you need?") or vocal prompts (e.g., "Wash your hands."). Benny gradually acquired tacts (e.g., labels of items) and intraverbals during his intervention services, and he maintained these skills once prompts were faded and reinforcement for correct responses was removed. However, he demonstrated consistent prompt dependence when manding items (e.g., asking to play with an iPad®).

Mario was a five-year-old boy with an ASD diagnosis. He demonstrated prompt dependence in completion of academic tasks, asking for preferred items, and performing daily living skills such as pulling up his pants after toileting. His caregivers frequently provided non-specific prompts (e.g., "What do you want?") and vocal prompts (e.g., "Pull up your pants.") at home. Mario used one-to-three word phrases to request items and label items in his environment.

Mario acquired mands and tacts rapidly during his early intervention services, but he rarely showed maintenance of skills unless prompts or continuous reinforcement were provided contingent on his responses.

Finn was a four-year-old boy with an ASD diagnosis. He demonstrated prompt dependence for toileting, asking for preferred items, and asking for breaks from academic tasks. His caregivers provided frequent and repeated vocal prompts (e.g., “Do you have to go potty?”) at home. Finn used short phrases to request preferred items and one-to-three word responses to describe items in his environment. Finn rapidly acquired tacts and a few intraverbals during his early intervention services and showed maintenance of these skills when his therapists faded prompts and thinned reinforcement for correct responses.

Setting and Materials

Sessions were conducted in the participant’s home. The specific location of sessions in the home was based on the tasks selected for inclusion in the study. For example, intervention for doing the laundry was conducted in the laundry room. Intervention including educational stimuli occurred at a table.

Materials included colored construction paper that was paired with intervention conditions, task materials (i.e., 3D plastic animals, hygiene items) associated with the target skill, data sheets, a timer, a video camera for reliability data recording, and tangible reinforcers unique to each participant based on the results of a preference assessment. Any unrelated materials were removed or restricted during sessions.

Response Measurement

The primary dependent variables were independent correct responses and prompted correct responses. *Independent correct responses* were defined as the participant engaging in a

pre-defined target response during the response interval and prior to a prompt. *Prompted correct responses* were defined as engaging in the pre-defined target response within 5 s following a prompt. Independent and prompted correct responses were converted to a percentage by dividing the number of responses by the total number of response opportunities in the session, and multiplying by 100.

The experimenter collected paper-and-pencil data on additional dependent variables during the prompt-dependence assessment. *Vocal prompts* were defined as any vocal instruction that guided the participant to engage in the correct response (e.g., “Get a fork”). *Gestural prompts* were defined as any physical movement or gesture that indicated the target response (e.g., pointing at a fork). A *model prompt* was defined as the experimenter demonstrating the skill and providing an opportunity for the participant to engage in the target response.

Interobserver Agreement and Procedural Integrity

Two independent observers collected paper-and-pencil data on all dependent variables during 30% to 44% of sessions. Observers were trained to collect data on all dependent variables. Observers were considered reliable and permitted to collect data during the investigation once they reached a criterion of at least 85% agreement with the primary data collector on all dependent variables across two consecutive sessions.

Interobserver agreement for all conditions was calculated using a trial-by-trial agreement method. Recordings for each trial were compared, and trials in which both observers agreed on the occurrence and nonoccurrence of dependent variables were scored as an agreement. The percentage of interobserver agreement was calculated by dividing the number of trials with an agreement by the total number of trials in a session, and multiplying by 100. Mean interobserver

agreement across conditions was 93% for Ralph (range, 75% to 100%), 100% for Benny, 95% for Mario (range, 78% to 100%), and 99% for Finn (range, 89% to 100%).

Two independent observers also collected data on procedural integrity during 30% to 44% of the sessions to ensure that procedures were implemented as described in the protocol. Data collectors recorded data on (a) the delivery of the correct task and materials based on the data sheet, (b) waiting the allotted time period for a participant response, (c) the delivery of a prompt, if necessary, (d) delivery of the prompt specified in the intervention protocol, if necessary, and (e) providing or withholding reinforcement, if necessary. Each component of the intervention had to be conducted accurately for a trial to be scored as an instance of procedural integrity. The percentage of procedural integrity was calculated for each session by dividing the number of correctly implemented trials by the total number of trials in the session, and converting the number to a percentage. Mean integrity was 90% for Ralph (range, 75% to 100%), 100% for Benny, 96% for Mario (range, 89% to 100%), and 99% for Finn (range, 89% to 100%).

Assessments

Prompt-dependence assessment. To identify participants for inclusion in the study, and the target skills to include in intervention, the experimenter conducted an assessment to measure prompt dependence during skills nominated by parents. The experimenter assessed the participant's engagement in the nominated task(s) using least-to-most prompting. The experimenter presented the task, and waited up to 5 s for a response. If the participant made an error or did not respond within the allotted time, the experimenter provided the least intrusive prompt (e.g., vocal prompt) and waited 5 s for a response. Following an error or no response, the

experimenter provided the next most intrusive prompt (e.g., a gestural prompt) and waited 5 s for a response. If a correct response did not occur, the experimenter provided the most intrusive prompt necessary to occasion a correct response (e.g., a model prompt). If at any point the participant engaged in an independent or prompted correct response, the experimenter provided praise.

We recorded data on independent and prompted correct responses. In addition, the experimenter collected data on the type of prompts provided during each skill (e.g., gestural prompts). Specific target skills were identified for each participant based on the results of the assessment. A target skill was included in the evaluation if (a) the experimenter provided at least one prompt during the task across at least 80% of task presentations, (b) the participant engaged in an independent correct response during 20% or fewer response opportunities, and (c) a prompted correct response occurred during at least 80% of opportunities (Cividini-Motta & Ahearn, 2013).

The skills that were assessed and met the inclusion criterion for Ralph were washing and drying his laundry, cleaning the bathroom, and making a microwave meal. Each task was equated for number of steps and step difficulty. The task analyses for each task can be found in Appendix A. Washing the laundry was assigned to the prompt-fading condition, drying the laundry was assigned to the extended response interval condition, making a microwave meal was assigned to the differential reinforcement condition, and cleaning the bathroom was assigned to the control condition.

Based on the results of the prompt-dependence assessments for Benny, Mario, and Finn, tacts of noun-verb combinations were identified as the target skills for these three participants.

The specific noun-verb tact targets can be found in Appendices B-D for each participant. All three participants could independently tact the targeted items and the action (following a non-specific vocal prompt; e.g., “What is it?”), but none of the participants combined the animal and action to produce an independent noun-verb tact of the target.

The experimenter identified a controlling prompt to include during intervention based on the participant’s responding during the assessment. The specific prompting level that reliably produced a prompted correct response during at least 80% of assessment trials was identified as the controlling prompt. A vocal prompt was identified as the controlling prompt for Ralph. A model prompt was identified as the controlling prompt for Benny, Mario, and Finn.

Stimulus preference assessment. A brief multiple stimulus without replacement preference assessment (Carr, Nicolson, & Higbee, 2000) was conducted with each participant to evaluate preferences for certain stimuli. The experimenter presented an array of five parent-nominated stimuli in a straight line, and instructed the participant to choose one. The selection was recorded, the participant received the selected item for 20 s, and that item was then removed from the array for the next trial. The participant continued to select stimuli until all items were selected or until the participant did not make a selection for 30 s. If the participant did not make a selection, the session was ended and the remaining items were scored as “not selected.” The two highest ranked items were used as reinforcers during intervention. However, if the participant asked for a different preferred item during the session, the experimenter provided the alternative item.

Color preference assessment. A paired-choice color preference assessment (Heal, Hanley, & Layer, 2009) was conducted with each participant to identify colors that were assigned to the three intervention conditions and the control condition. There were eight colored

cards, and every colored card was paired with every other colored card for a total of 28 pairings. The experimenter presented pairs of stimuli to the participant one at a time, in a random order, and prompted the participant to “pick one.” Participant selection of a colored card produced brief praise. The participant’s choice of colored card was scored, and a selection percentage was obtained by dividing the number of times a color was selected by the total number of times the color was presented, multiplied by 100.

The four colors identified as moderately preferred (i.e., colors that were scored in the middle of the preference hierarchy) were selected to be associated with the three conditions, plus a control condition. The purpose of this assessment was to reduce the likelihood that a pre-existing color preference would influence the participant’s responding during intervention and control sessions. These four colors were randomly assigned to a condition, and the color assignment was held constant throughout all phases of the experiment.

Echoic assessment. Mario and Finn both had difficulty annunciating longer phrases. For these participants, an echoic assessment was conducted to identify acceptable approximations to the target response for their noun-verb tact targets. The experimenter vocally modeled each noun-verb tact target response (in the absence of the stimuli), and recorded the participant’s echoic approximation. Each target was presented twice, and the lowest form of the approximation was selected as an acceptable target response during intervention.

Procedure

An adapted alternating treatments design was used to compare the effects of three treatment conditions and a control condition on independent correct responses. One or two sessions of each condition were conducted per day, two to three days per week. Each session consisted of 11 to 13 steps (Ralph) or nine trials (Benny, Mario, and Finn). Each trial was

comprised of a step in a behavior chain (e.g., putting detergent into the washing machine) or a response to a stimulus (e.g., a tact). The targeted skill(s) in a condition were considered mastered when a participant had two consecutive sessions with at least 80% independent correct responses. A condition was discontinued when two times the number of sessions required to master stimuli in one condition were completed and there was no increasing trend in independent responding.

Baseline. The experimenter initiated a trial and waited up to 5 s for a response. The experimenter provided praise contingent on independent correct responses. If the participant did not respond or responded incorrectly, no feedback was provided and the next trial was presented. If the task was a behavior chain, the experimenter completed the behavior for the participant contingent on an error or no response and then waited 5 s for the participant to begin completing the next behavior in the sequence. The baseline phase consisted of at least three sessions and continued until stable levels of responding were observed.

Differential reinforcement. The experimenter initiated a trial and waited up to 5 s for a response. Independent correct responses resulted in praise and an edible, token, or access to a tangible item for 20 s. Following an error or no response during the allotted period of time, the experimenter provided a controlling prompt (i.e., vocal prompt for Ralph, model prompt for Benny, Mario, and Finn, based on the results of the prompt-dependence assessment) and waited up to 5 s for a prompted correct response. Only praise was provided following prompted correct responses. The purpose of this condition was to test whether reinforcement contingencies effect independent responding. Although the experimenter provided a prompt during trials, prompted responses were placed on extinction.

Prompt fading. Similar to the differential reinforcement condition, the experimenter initiated a trial, waited up to 5 s for a response, and provided praise and an edible, token, or tangible item for 20 s following an independent correct response. If the participant did not engage in an independent correct response within the allotted time, a full vocal (Ralph) or model (Benny, Mario, and Finn) prompt was provided. For example, a full model prompt for tact training involved modeling the correct response (e.g., “frog jumping”). The experimenter waited up to 5 s for a prompted correct response, and praise and an edible, token, or tangible item for 20 s was provided following a prompted correct response.

Prompts were faded after the participant responded correctly to prompts during at least 80% of prompted response opportunities during a session. Prompt fading occurred across two steps. Full prompts were faded to a partial prompt, and partial prompts were faded to a lesser partial prompt. For example, the full vocal model prompt was faded from “frog jumping” to the partial vocal model prompt “frog ju.” Thereafter, the partial prompt, “frog ju” was faded to the lesser partial prompt, “fr.” The purpose of this condition was to test whether prompt fading would gradually transfer control over correct responding from the prompt to the antecedent stimulus programmed in the trial despite the provision of reinforcement for independent and prompted correct responses.

Extended response interval. The experimenter presented the trial and waited for an independent correct response for 10 s. Praise and a token, edible, or preferred tangible was provided for 20 s following independent correct responses. No prompts were provided during this condition. Thus, if the participant did not engage in an independent correct response within the allotted time, or an incorrect response occurred, the experimenter discontinued the trial. If the participant was completing a behavior chain, the experimenter completed the behavior for the

participant (e.g., the experimenter placed the wet clothes in the dryer) and moved to the next behavior in the sequence. The purpose of this condition was to evaluate whether the skill was in the participant's repertoire and would be more likely to occur if prompts were removed, an extended time period was provided, and reinforcement contingencies were arranged to favor independent responding.

Control. Control was conducted exactly the same as baseline. Control sessions were conducted once every two sessions of treatment (e.g., every six sessions).

RESULTS

Low levels of independent correct responding were observed in baseline for all four participants. When treatment was implemented, the most efficient and efficacious intervention was idiosyncratic across participants. Figures 1 through 4 show the percentage of independent correct responding across conditions during baseline and treatment comparison for each participant.

Figure 1 depicts Ralph's data. Ralph had low levels of independent correct responding in baseline for all four targeted daily living skills. Independent correct responses rapidly increased and met the mastery criterion after only four sessions of treatment in the extended response interval condition. Prompt fading also produced an increase in independent correct responding that reached mastery criterion following eight sessions of treatment, showing that it was an effective intervention, though not as efficient as the extended response interval procedure for Ralph. The task assigned to the differential reinforcement condition reached the discontinuation criterion, and the extended response interval procedure was implemented for this task. Following exposure to the extended response interval, independent responding reached mastery within two sessions. Responding remained low and variable in the control condition throughout the

evaluation. Ralph's results showed that the most effective and efficient condition was the intervention in which no prompts were provided (i.e., extended response interval condition), and providing prompts, even with differential reinforcement, produced an ongoing dependence on prompts.

Benny's data are depicted in Figure 2. Benny's levels of independent correct responding increased when treatment was introduced in the prompt-fading and differential reinforcement conditions. Responding met the mastery criterion in the differential reinforcement condition in six sessions, with 27 min and 41 s of instruction. Correct responding increased in the prompt-fading condition, and the prompt was faded to the lesser partial model (e.g., "fr"). Nevertheless, after double the number of training sessions required to produce mastery in the differential reinforcement condition, responding to the stimuli in the prompt-fading condition was not at mastery level. Thus, we discontinued prompt fading. Correct responses rarely occurred in the extended response interval condition, and responding was discontinued based on the discontinuation criterion.

After discontinuing the prompt fading and the extended response interval conditions, those stimuli were exposed to differential reinforcement. Stimuli that were previously in the prompt-fading condition were mastered in just three sessions of differential reinforcement (57 min and 59 s), suggesting that these responses may have been acquired but were not occurring independently due to ongoing prompt dependence. Correct responding gradually increased for stimuli that had been assigned to the extended response interval condition once differential reinforcement was initiated. Nevertheless, due to stalled improvements in responding, we added error correction to differential reinforcement at session 83. During error correction, the experimenter repeated the trial until Benny engaged in a correct independent response.

Independent responses following error correction are not displayed in the figure. Following the introduction of error correction, responding increased and met the mastery criterion in 45 sessions, with 113 min and 42 s of instruction. Benny's responding to targets in the control condition, which were not exposed to treatment, remained near zero throughout treatment. Overall, Benny's results show that differential reinforcement was the most efficacious and efficient intervention condition.

Mario's data are shown in Figure 3. Zero levels of independent correct responding were observed in baseline for Mario. Following the introduction of treatment, there was an increase in levels of independent correct responding that met the mastery criterion in all three treatment conditions. The extended response interval condition was mastered within five sessions, or 30 min and 33 s of instruction. The prompt-fading condition also was mastered within five sessions, or 32 min and 45 s of instruction. Because Mario's correct responding during prompt fading did not increase until the second to last treatment session, we did not have a chance to fade to lesser prompts prior to mastery. Thus, Mario did not require prompts to be faded to the lesser partial model for independent correct responding to emerge and reach the mastery criterion. The differential reinforcement condition was mastered in eight sessions, or 47 min and 42 s of instruction. Responding remained low in the control condition throughout the treatment comparison. Mario's results showed that the extended response interval and prompt-fading conditions were similarly efficacious and efficient.

Figure 4 shows the results for Finn who engaged in low levels of independent correct responding in baseline. Following the introduction of treatment, Finn's independent correct responding increased and reached mastery in all three treatment conditions and the control condition. Targets in the prompt fading condition were mastered within four sessions, or 32 min

and 10 s. The differential reinforcement condition was mastered within five sessions, or 30 min and 42 s. The extended response interval condition was mastered within seven sessions, or 33 min and 37 s. In addition, the control set was mastered within three sessions, although sessions of this condition were conducted intermittently during the comparison. Therefore, Finn's results suggest that intervention conditions that did and did not include prompts and reinforcement are efficacious training procedures.

DISCUSSION

The current study compared three empirically-validated interventions that were previously used to prevent prompt dependence to treat pre-existing prompt dependence with four participants. Although all four participants were referred for intervention because they displayed prompt dependence during various tasks, the most efficient and efficacious intervention differed across participants. The extended response interval was the most efficacious and efficient for Ralph. Differential reinforcement was the most efficacious and efficient intervention for Benny. Two or more interventions were similarly efficacious and efficient for the remaining two participants. The outcomes of this assessment that show that participants with similar referral concerns respond differently to interventions is consistent with previous literature supporting the necessity of assessments that identify the most efficient and efficacious procedure for each individual (Kodak et al., 2013; Lermann et al., 2004; Libby et al., 2008; Seaver & Bourret, 2014; Walls, et al., 1979).

This study extends the literature by comparing procedures that can be used to treat prompt dependence. Although previous research has examined these procedures individually, no other studies have arranged a comparison to determine whether one or more of these procedures may be more efficacious or efficient. However, the results of the comparison are consistent with

the previous literature showing that the most efficacious and efficient intervention likely varies across participants. Thus, future research and clinical practice should emphasize the importance of conducting these comparisons with each individual for whom the intervention will be applied, rather than attempting to identify one intervention that is likely to be ideal for all clients.

This study also extends the literature on assessment-based intervention by comparing procedures that can be used to treat prompt dependence during various types of skills. Although clinical training data for the participants are not included in the manuscript (data available upon request), the assessment results were applied to successfully treat prompt dependence for additional skills for which both Benny and Ralph displayed ongoing prompt dependence in their homes. Additional validations of this comparison will provide further evidence for the application of assessment-based instruction to the selection of interventions for prompt dependence.

This is only the second study that we are aware of that evaluated the efficacy of an extended response interval as a treatment (Walls et al., 1984). This intervention may be efficacious for individuals who are frequently exposed to prompts provided at the onset of a task. The results showed that this intervention was efficacious for three of the four participants and was the most efficient for two participants. It is possible that longer response intervals may be needed to treat prompt dependence for other individuals, and future researchers could further investigate the efficacy of the extended response interval with more participants, particularly participants for whom latencies to initiate a response are relatively long.

Our findings extend the results of Karsten and Carr (2009) and Cividini-Motta and Ahearn (2013), who found differential reinforcement to be an effective procedure for preventing prompt dependence during novel skill acquisition. The differential reinforcement condition was

the most efficacious and efficient intervention for two out of four participants in the current study. It was an effective intervention for three out of four participants, though it was not as efficient as another intervention procedure for one of those three participants. It is possible that the provision of reinforcement only for independent responses at the start of intervention reduced the efficiency of this procedure. That is, reinforcement for prompted responses at the start of treatment could have brought responding under the control of a prompt more rapidly. The subsequent removal of reinforcement following a prompted response may quickly transfer control over responding from the prompt to the discriminative stimulus. Future research could examine how the inclusion of reinforcement for prompted responding with a criterion for fading reinforcement for prompted responses once responding has reached a certain level of independence might affect the results of treatment for prompt dependence.

Finally, our findings replicate the results of Bourret et al. (2004) who found that prompt fading is an effective procedure for treating pre-existing prompt dependence. However, this intervention was not as efficient as other intervention procedures for any of the four participants, and was not an effective intervention for one participant. Prompt fading was the second-most efficient procedure for three out of four participants. It is possible that the continuation of reinforcement following prompted responses reduced the efficiency of this procedure. Researchers could consider combining prompt-fading with differential reinforcement to determine whether the removal of reinforcement for prompted responses once the prompt is faded might help facilitate a more rapid transfer of control from the prompt to the initial discriminative stimulus.

There are a few limitations to the current study that should be noted. First, daily living skills tasks could not be completely equated for all variables (e.g., response effort, length of time

to complete the task), which could have affected Ralph's performance across tasks. Future research should evaluate each intervention under conditions in which tasks are more closely equated across variables such as response effort and number of steps.

Second, Ralph's control condition reached 50 % independence without intervention for this task, but it did not reach a level that was above baseline responding. Nevertheless, Finn's responding in the control condition reached mastery level. Since Ralph and Finn displayed prompt dependence with these targets skills, these tasks and stimuli may have already been acquired prior to intervention. The adapted alternating treatments design may have contributed to carryover effects across conditions. Future researchers may be able to avoid increasing levels of correct responding in the control condition by using a more stringent inclusion criterion in the prompt dependence assessment (higher levels of prompt dependence with the task) or by evaluating the effects of each intervention individually rather than alternating between multiple intervention conditions simultaneously.

In addition, we targeted noun-verb facts for three participants and daily living skills requiring extended response chains for only one participant. Due to the paucity of research on intervention for pre-existing prompt dependence, additional studies that include more participants and varying targeted skills will add to the generality of these findings.

We added error correction to differential reinforcement during Benny's evaluation following stalled progress in responding for one stimulus set. Initially, the stimulus set was exposed to the extended response interval, and Benny frequently engaged in errors during these trials. A consistent error pattern persisted once the extended response interval was discontinued and differential reinforcement was implemented despite a gradual increase in correct responses during the differential reinforcement sessions. The introduction of error correction provided

additional opportunities for Benny to practice engaging in the correct response during the instructional trial, and this modification led to mastery. Although it is unclear whether Benny's responding would have eventually reached the mastery criterion with differential reinforcement alone, the results suggest that extended exposure to opportunities to engage in errors may have decreased the efficacy of differential reinforcement. Researchers and practitioners should consider the benefits of the extended response interval during instruction in comparison to the potential limitations of opportunities for error patterns to develop in the absence of prompts.

Finally, the timeline of this study did not allow for replication of results within participants across different tasks in which prompt dependence was observed. Anecdotally, Benny's comparison results were extended to successfully address prompt dependence during two additional skills in his home environment (i.e., hand washing, mand for a break with an iPad®; data available upon request). Ralph's results were extended to effectively address prompt dependence during a cooking task (i.e., making Kraft® macaroni and cheese; data available upon request). Additional researchers could use these assessment methods to identify the most efficacious and efficient procedure and then apply the findings to other areas in which the participant demonstrates prompt dependence.

In conclusion, differential reinforcement, prompt fading, and providing an extended response interval are all effective interventions for addressing pre-existing prompt dependence, although results for the most efficient intervention differed across participants. These findings emphasize the necessity of conducting an assessment with each individual to identify the most efficient and efficacious procedure for addressing pre-existing prompt dependence.

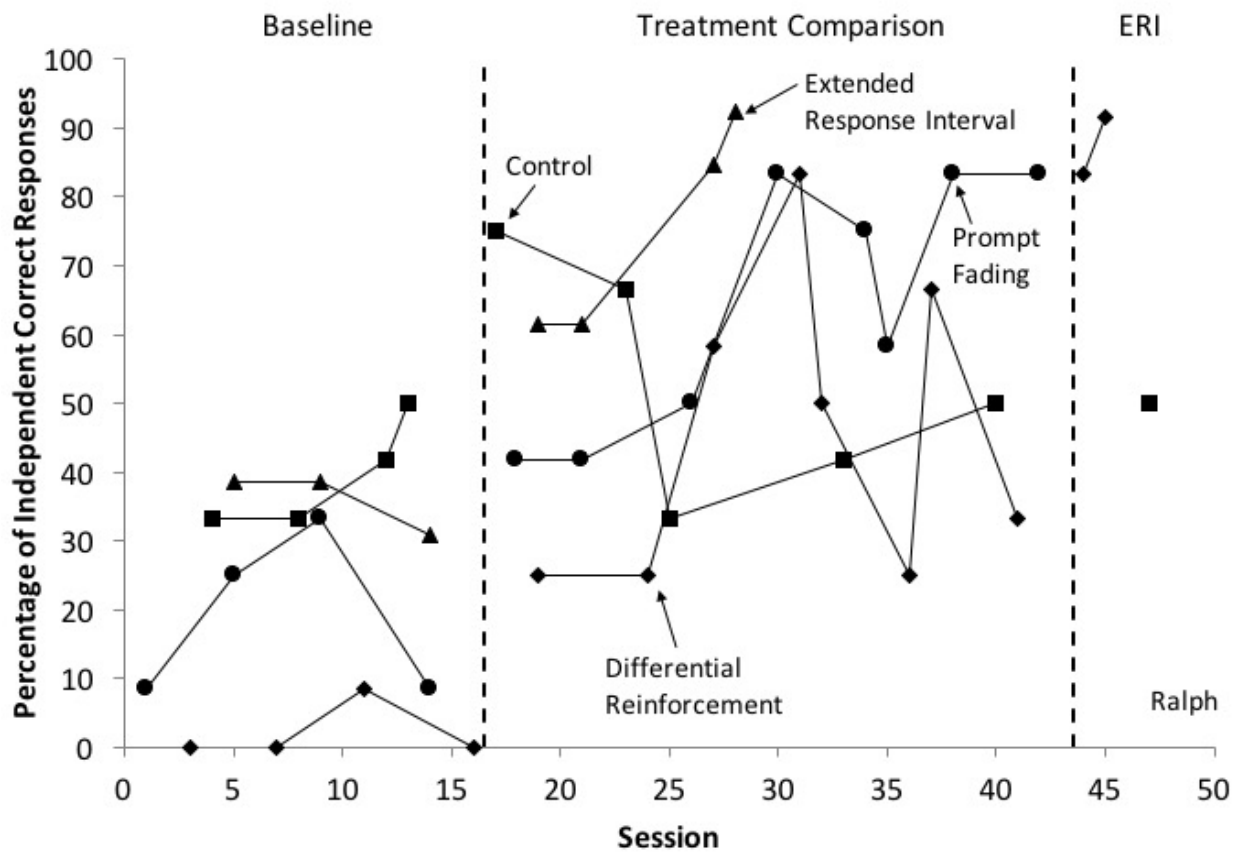


Figure 1. The percentage of independent correct responding across conditions for Ralph. ERI = Extended Response Interval

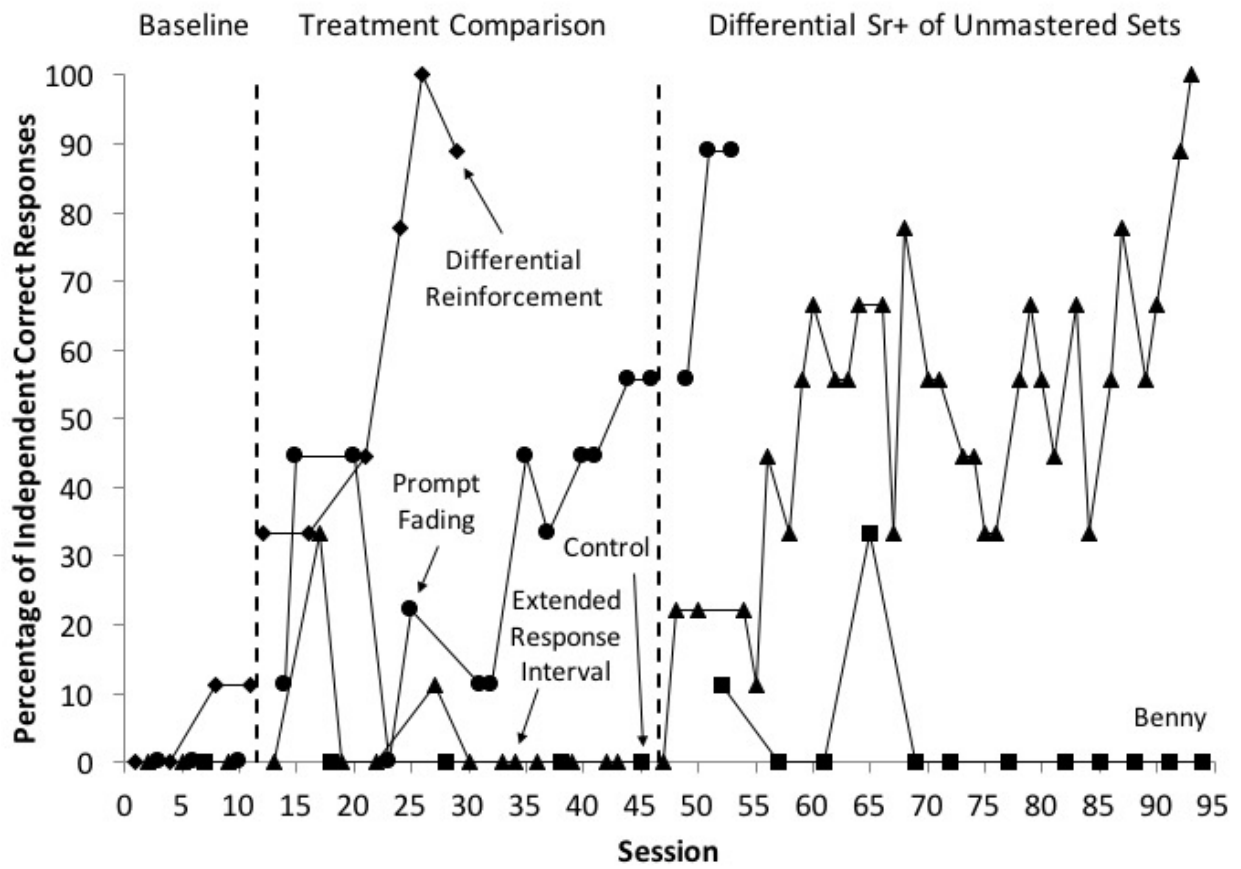


Figure 2. The percentage of independent correct responding across conditions for Benny.

Differential Sr+ = Differential Reinforcement

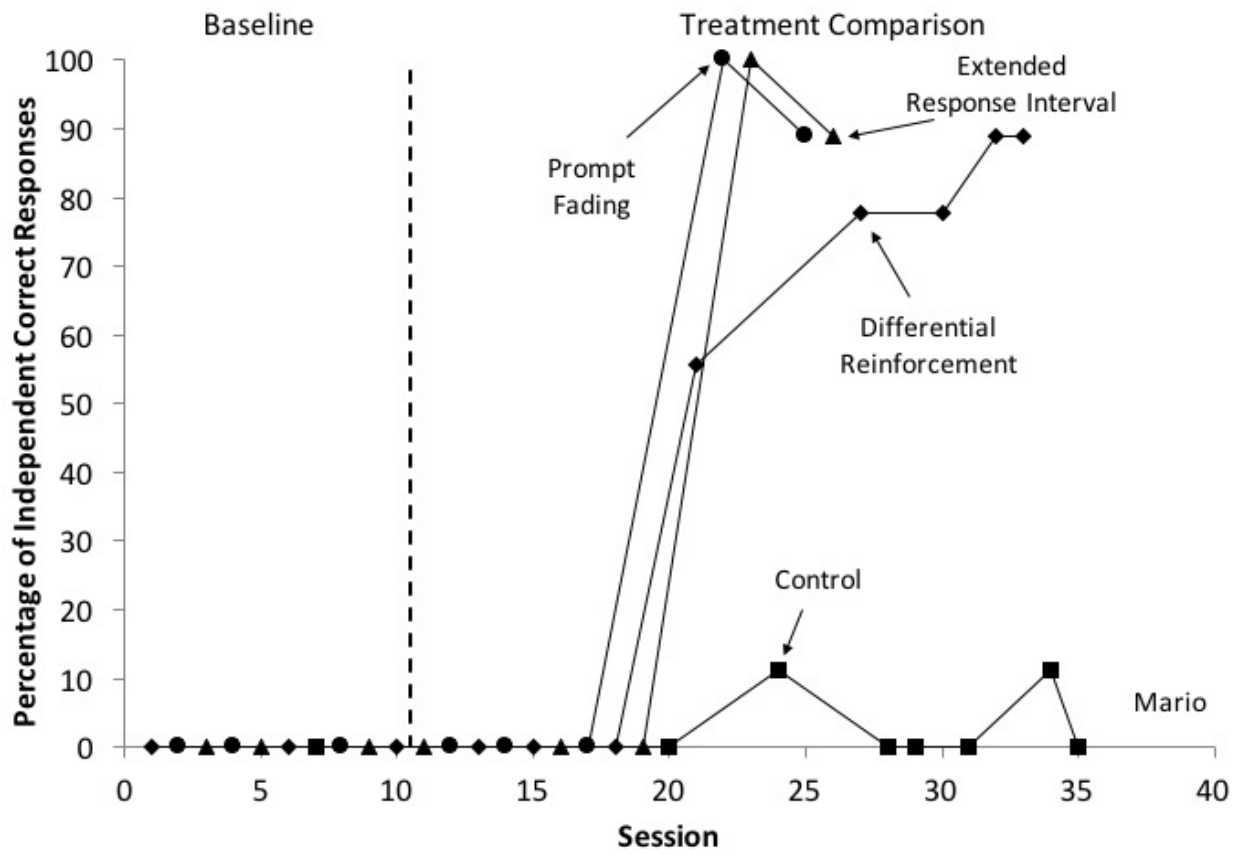


Figure 3. The percentage of independent correct responding across conditions for Mario.

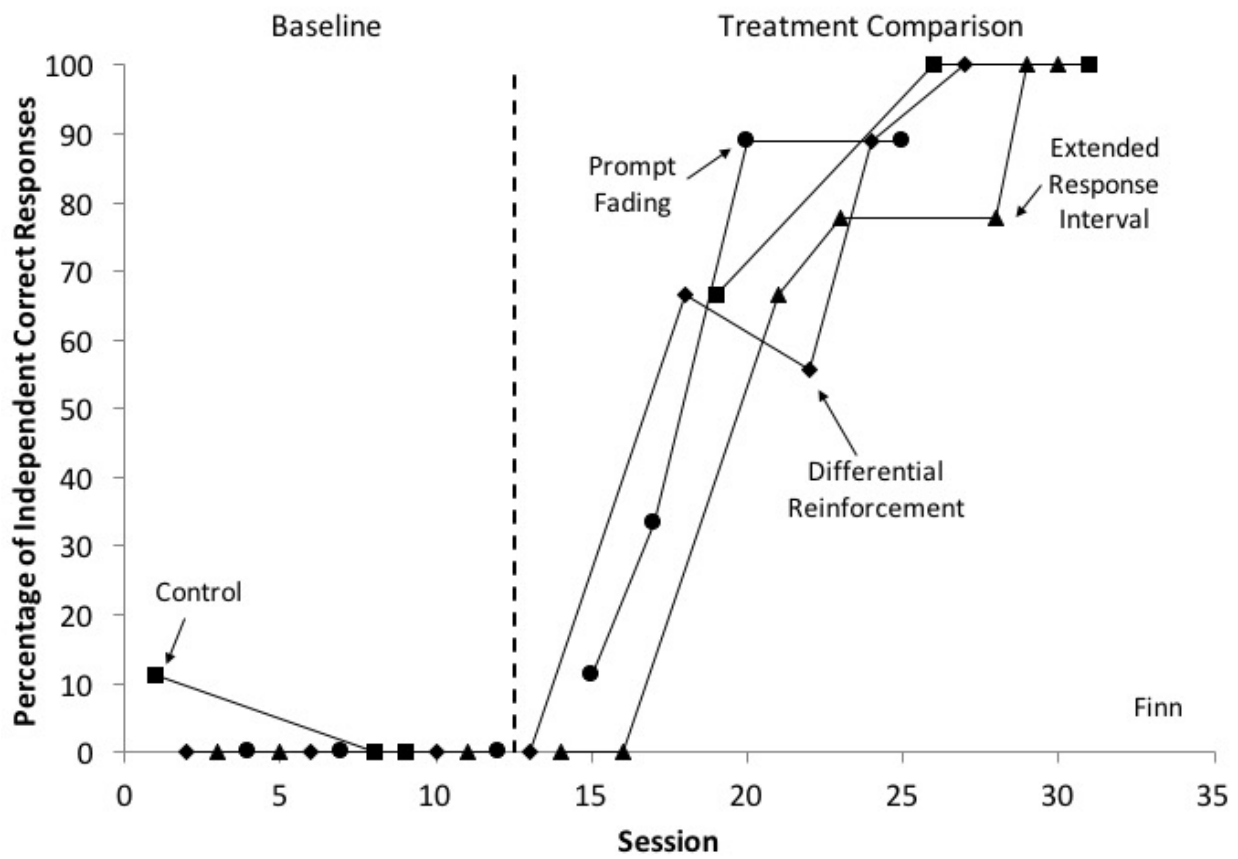


Figure 4. The percentage of independent correct responding across conditions for Finn.

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Appendix A

Task Analyses for Ralph's Target Skills

Washing the laundry

1. Put laundry in hamper
2. Bring hamper to laundry room
3. Check pockets for items
4. Put clothes into washer
5. Get detergent from shelf
6. Measure detergent liquid
7. Put detergent in washer
8. Close washer lid
9. Choose load setting
10. Start washer
11. Set timer for 35 minutes
12. Check washer when timer goes off

Making a Microwave Meal

1. Take meal out of freezer
2. Peel back one corner to vent the lid
3. Put meal in microwave
4. Microwave for 1 minute (involved one button-push)
5. Take out of microwave
6. Get fork
7. Stir
8. Finish time (1 minute)
9. Take out of microwave
10. Take off lid
11. Put meal on plate
12. Throw away container

Drying the laundry

1. Move clothes from washer to dryer
2. Put dryer sheet in the dryer
3. Close dryer door
4. Choose load setting
5. Start dryer
6. Set timer for 50 minutes
7. Check dryer when timer goes off
8. Put clothes into hamper
9. Check lint trap
10. Throw out lint
11. Put lint trap back in
12. Fold clothes
13. Put clothes away

Cleaning the Bathroom

1. Get cleaning solution
2. Get paper towel
3. Move items off of counter
4. Spray mirror
5. Wipe off mirror
6. Spray counter
7. Wipe off counter
8. Spray sink
9. Wipe off sink
10. Put items back onto the counter
11. Throw out towels
12. Put away cleaning solution

Appendix B

Benny's Noun-Verb Tact Targets

Set 1 (Prompt-fading condition)

- Giraffe jumping
- Bear sneezing
- Sheep walking

Set 2 (Extended response interval condition)

- Dog running
- Hippo drinking
- Tiger laying

Set 3 (Differential reinforcement condition)

- Lion eating
- Cow sitting
- Gorilla climbing

Set 4 (Control condition)

- Zebra coughing
- Horse standing
- Cat swinging

Appendix C

Mario's Noun-Verb Tact Targets

Set 1 (Prompt-fading condition)

- Zebra coughing
- Donkey standing
- Pig singing

Set 2 (Extended response interval condition)

- Lion sneezing
- Cow sleeping
- Gorilla laughing

Set 3 (Differential reinforcement condition)

- Mouse yawning
- Elephant drinking
- Chicken sitting

Set 4 (Control condition)

- Giraffe jumping
- Bear eating
- Sheep snorting

Appendix D

Finn's Noun-Verb Tact Targets

Set 1 (Prompt-fading condition)

- Pig yawning
- Lion stomping
- Dog eating

Set 2 (Extended response interval condition)

- Giraffe dancing
- Zebra singing
- Cat sneezing

Set 3 (Differential reinforcement condition)

- Bear coughing
- Sheep sleeping
- Crocodile jumping

Set 4 (Control condition)

- Cow spinning
- Monkey walking
- Horse laughing