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Differential Reinforcement without Extinction: An Assessment of Sensitivity to and Effects of Reinforcer Parameter Manipulations

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Differential Reinforcement without Extinction: An Assessment of Sensitivity to and Effects of
Reinforcer Parameter Manipulations

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
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ABSTRACT

Individuals with an Autism Spectrum Disorder (ASD) often engage in problem behavior (e.g., aggression, property destruction, self-injurious behavior; Horner et al., 2002) that may limit access to traditional social and education settings, impact their health, and pose a risk to their safety and the safety of others. One of the most common interventions used to treat problem behavior is differential reinforcement of alternative behavior (DRA; Petscher et al., 2009; Vollmer & Iwata, 1992), which are often used in combination with other interventions such as extinction (Shirley et al., 1997). However, implementation of extinction may pose an ethical dilemma and may not be feasible depending on the setting, topography of problem behavior, and/or size of the client. In addition, its effectiveness relies on optimal treatment integrity (Fisher et al., 1993; Hagopian et al., 1998) across all contexts and implementers. Therefore, the purpose of this study was to evaluate the effects of two variations of DRA (i.e., functional communication training; FCT) without extinction on problem behavior and communicative responses. The two FCT procedures were designed based on results of stimulus magnitude and delay value sensitivity assessments as well as relative parameter sensitivity assessments. The study employed a reversal design to evaluate the efficiency and effectiveness of the two variations of FCT. In the current study, both FCT interventions were effective in decreasing problem behavior and increasing communication for all participants. However, session duration and rates of functional communication responses differed across participants.

CHAPTER ONE:

INTRODUCTION

Autism Spectrum Disorder and Problem Behavior

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and interactions as well as increased levels of restricted and/or repetitive patterns of behavior (American Psychiatric Association, 2013). Although problem behavior is not a diagnostic feature of ASD, individuals with ASD often engage in problem behavior (Dominick et al., 2007). For instance, Dominick et al. (2007) used a parent interview to measure the prevalence of various topographies of problem behavior in a sample of 54 children with ASD. Results of this study showed that either presently, or at some point in their life, 33% of individuals engaged in self-injurious behavior, 33% in aggression, and 71% in tantrums. The high incidence of problem behavior in individuals with ASD warrants our attention because problem behavior can negatively impact the lives of both the individual and their family. More specifically, the presence of problem behavior can impair the individual's social functioning, hinder educational outcomes, and limit access to community resources, resulting in a diminished quality of life (Newcomb & Hagopian, 2018). Furthermore, raising a child with ASD and behavioral problems can increase demands on caregivers, familial stress, and result in self-reported low levels of parenting efficacy (Tarver et al., 2019). Given these plausible negative outcomes, effective and efficient treatment of problem behavior is necessary.

Functional Behavior Assessment

Functional behavior assessment (FBA) is a widely supported practice that identifies why a child engages in certain problem behavior by identifying environmental antecedents and consequences that maintain and control that behavior (Newcomb & Hagopian, 2018). FBAs have been used to identify the function of various topographies of problem behavior such as SIB (e.g., Iwata et al., 1982/1994), aggression (e.g., Borrero et al., 2004; Carr et al., 1980), and elopement (e.g., Lang et al., 2010). FBAs are essential to the treatment of problem behavior because these assessments take into account the individual's learning history in order to develop a precise and effective treatment plan (Hanley, 2012). Behavioral interventions, broadly defined, are effective in reducing problem behavior in individuals with autism. However, when a FBA is conducted prior to treatment implementation and used to design a function-based intervention, greater treatment effects are achieved compared to when a functional assessment is not conducted (see Campbell, 2003, for a review). Moreover, when a FBA is conducted, treatments are more likely to use reinforcement-based procedures rather than punishment-based procedures (Campbell, 2003), leading to socially acceptable (Gabor et al., 2016) and sustainable behavior change (Holz et al., 1963; Thompson et al., 1999).

Several types of FBA are currently available including indirect assessments, descriptive assessments, and functional analyses (Hanley, 2012). Indirect assessments do not involve direct observation of the target behavior; thus, these usually consist of questionnaires and interviews completed by caregivers. Descriptive assessments involve direct observation of the behavior without any manipulation of the environmental conditions. Therefore, indirect and descriptive assessments identify only correlational relations between environmental variables and problem behavior (Camp et al., 2009). Functional analyses, however, include both direct

observation of the behavior and manipulation of some environmental stimulus (Hanley, 2012). In a functional analysis, as described by Iwata et al. (1982/1994), contingencies are intentionally manipulated to assess their effect on the target behavior. The function of problem behavior is identified when a set of antecedent and consequence reliably predict and control the occurrence of the target behavior. Functional analysis is the only type of FBA to demonstrate a causal relationship between environmental variables and problem behavior (Camp et al., 2009). Furthermore, functional analyses are more reliable in identifying the maintaining reinforcers for problem behavior compared to indirect and descriptive assessments (Camp et al., 2009; Iwata et al., 2013) and thus are the gold standard for the assessment of problem behavior (Hagopian et al., 2013).

Function-Based Interventions

A review by Campbell (2003) demonstrated that one of the most effective ways to reduce problem behavior is through the use of function-based interventions. Rather than focusing on topography of problem behavior, function-based interventions require the identification of the variables reinforcing problem behavior (i.e., functional reinforcer) so that the access to the functional reinforcer is then provided noncontingently (e.g., noncontingent reinforcement; NCR) or contingent on the occurrence of appropriate responses (e.g., differential reinforcement of alternative behavior; DRA). Non-function-based interventions can have several undesirable side-effects such as unintentionally strengthening problem behavior (e.g., using time-out for escape-maintained behavior; Plummer et al., 1977), increasing the occurrence of non-target behaviors (e.g., adventitious reinforcement in DRO procedures; Jessel, Borrero, & Becraft, 2015; Rey et al., 2020), and lack of therapeutic effects (Iwata et al., 1994). Given the potential side effects of

designing treatment plans that do not address the function of problem behavior, the use of function-based interventions to treat problem behavior is imperative.

Although many function-based interventions are effective in reducing problem behavior, those that do not teach an alternative behavior may breach the fair-pair rule (White & Haring, 1980), which requires teaching of an alternative response, our ethical principle to respect human rights and dignity (APA ethical guidelines, Principle E, 2017), and the BACB® ethical code that recommends use of reinforcement procedures rather than punishment procedures whenever possible (BACB® ethics code, 4.08a, 2014). Furthermore, function-based interventions such as NCR or extinction (EXT) may result in a reduction of the target behavior but may be difficult to implement consistently over extended periods of time (i.e., NCR; Carr et al., 2000) or may have serious side effects such as worsening the problem behavior (i.e., extinction-burst; Lerman et al., 1999). Moreover, function-based interventions that teach and reinforce an alternative behavior establish a new relation between an appropriate response and a reinforcer which may promote maintenance of treatment outcomes (Carr et al., 2000). Therefore, the ultimate goal of an intervention to reduce problem behavior should be to teach the individual an appropriate replacement behavior that results in access to the same reinforcer that was shown to maintain problem behavior. That is, the intervention should be, or should include, a DRA component. This recommendation is supported by findings from a literature review of 116 studies that found that DRA, and other interventions that included a DRA component, were effective in reducing various topographies of problem behavior across a variety of ages and disabilities (Petscher et al., 2009).

Functional Communication Training. A type of DRA procedure is functional communication training (FCT; Carr & Durand, 1985). FCT involves teaching an individual a

communicative response that results in access to the same reinforcer that maintains problem behavior (i.e., functional communication response; FCR). In addition to deeming DRA an effective treatment for reducing problem behavior in individuals with various disabilities, Petscher et al. (2009) note that of all of the articles included in their review, over 70% of the studies implemented FCT. Furthermore, FCT appears to have advantages over other function-based treatments (e.g., Durand & Carr, 1992; Kahng et al., 1997). For instance, Durand and Carr (1992) compared the effects of FCT and time-out on attention-maintained problem behavior of 12 individuals. Authors found that both interventions were initially effective, but FCT led to long-term treatment effects. In contrast, for individuals who experienced time-out as a treatment, problem behavior reemerged in the presence of individuals that were I to the previous time-out intervention. Similarly, Kahng et al. (1997) compared FCT and NCR to treat SIB in three adults with disabilities. Authors found that although both interventions were effective in suppressing problem behavior, FCT was advantageous because it increased occurrences of appropriate responses (i.e., FCRs) compared to NCR.

FCT with and without Extinction. Although not a requirement, in many applications of FCT, problem behavior no longer results in access to the functional reinforcer (i.e., EXT is implemented). For instance, a literature review by Gerow et al. (2018) identified 135 FCT evaluations (i.e., participants) in which FCT was effective in reducing problem behavior; 95% of these cases included an extinction component (n= 128). Previous studies have also compared FCT with and without extinction (Hagopian et al., 1998; Shirley et al., 1997) and found that, at least in some cases, extinction is necessary. For instance, Hagopian et al. (1998) assessed the effects of FCT alone, FCT plus extinction, and FCT plus punishment on severe problem behavior. This study included 11 evaluations of FCT alone and 25 of FCT plus extinction.

Although both procedures resulted in reductions of problem behavior for some cases, FCT alone did not reduce problem behavior to below 90% of baseline for any cases. Conversely, FCT with extinction led to a reduction of problem behavior in 22 evaluations and in 50% of these, problem behavior decreased to below 90% of baseline levels. Similarly, Shirley et al. (1997) also evaluated FCT with and without extinction on the self-injurious behavior (SIB) of three individuals. In this study, SIB remained at baseline levels during FCT until the extinction component was added. Furthermore, a review conducted by Kurtz et al. (2011) examined 28 studies in which FCT had a therapeutic effect (i.e., reduction in problem behavior and increase in the FCR) across 106 applications. In 21 of these studies which included 53 applications, FCT plus extinction was effective in reducing problem behavior. In contrast, FCT alone was only effective at reducing problem behavior and increasing the FCR in two applications. For the remaining 51 applications, a combination of FCT, extinction, and punishment was implemented. Taken together, results of these evaluations suggest that FCT with extinction is an effective intervention for problem behavior, and that, at least in some cases, extinction is a necessary component.

Extinction and Possible Side Effects

Extinction alone or in combination with other interventions has been shown to decrease problem behavior (Iwata et al., 1994). In applied research, extinction has been implemented to treat problem behavior with various functions. For example, in the case of problem behavior maintained by access to social positive reinforcement in the form of attention, problem behavior has been reduced by withholding the delivery of attention or terminating attention contingent on the emission of problem behavior (e.g., Magee & Ellis, 2000). Extinction has also been used to treat problem behavior maintained by social-negative reinforcement in the form of escape by

continuing to place task demands or not allowing the individual to escape the situation in which the behavior is occurring (e.g., Anderson & Long, 2003). Additionally, extinction can be used to reduce problem behavior maintained by automatic reinforcement. For example, Rincover and Devany (1982) implemented sensory extinction to treat automatically maintained SIB through use of a padded helmet (Brian), wearing gloves (Sara), or use of padded walls (David). Although extinction alone is rarely recommended (Iwata et al., 1994), extinction procedures can produce robust treatment effects and can be an integral component of treatment packages (Newcomb & Hagopian, 2018).

Extinction is effective, and in some cases necessary (Shirley et al., 1997). However, results of both basic and applied research has shown that extinction may result in undesirable side effects such as a temporary increase in the frequency, duration, or magnitude of problem behavior (i.e., extinction burst) or an overall increase in aggression (i.e., extinction-induced aggression; Alessandri et al., 1990; Keller & Schoenfeld, 1950; Lerman et al., 1999; see Lerman & Iwata, 1996 for a review). Lerman et al. (1999) reviewed 41 data sets for individuals who had received treatment for SIB and found that extinction bursts or extinction-induced aggression occurred in about 50% of the cases. It is important to note, however, that when extinction was implemented in conjunction with another treatment component (e.g., DRA, NCR), extinction bursts occurred in fewer cases (15% of cases). Although the undesirable side effects of extinction are less common when extinction is part of a treatment package, any increase in problem behavior, whether in frequency, duration, topography, or magnitude, may increase the risk of injury to the individual and to others, such as caregivers.

Treatment Integrity during Extinction

In addition to considering the potential undesirable side effects of extinction, additional factors to be taken into account when deciding whether to use extinction is its implementation feasibility and its reliance on high treatment integrity (St. Peter Pipkin et al., 2010; Vollmer et al., 1999). For instance, St. Peter Pipkin et al. (2010) noted that caregivers may struggle to consistently implement extinction due to long histories of reinforcing problem behavior, the size of the individual and/or the magnitude of the target response (i.e., unable to block or prevent access to the reinforcer), and the inability to control the environment where problem behavior occurs. Furthermore, in certain contexts such as schools, extinction may not be permitted due to safety concerns for the individual and other students, as well as poor implementation due to complexity and incompatibility with other school requirements. Therefore, extinction may not be appropriate for all contexts, topographies of problem behavior, and/or clients.

In addition, results of previous research suggest that extinction may not be effective in reducing problem behavior unless it is consistently implemented. This may be the case because failures in treatment integrity may lead to thin and intermittent reinforcement of problem behavior and thus make it more resistant to extinction (Bijou, 1957). For instance, Vollmer et al. (1999) evaluated the effectiveness of DRA plus extinction at varying levels of treatment integrity. First, authors examined DRA implemented at full integrity (all appropriate behavior reinforced, and all problem behavior put on extinction; 100/0). They then programmed treatment implementation errors at various parameters to mimic schedules of reinforcer delivery that may be in effect in the natural environment. Both errors of omission (i.e., reinforcer was not delivered following appropriate behavior) and errors of commission (i.e., reinforcer was delivered after problem behavior) were included. For example, in the 25/75 condition, one out of every four

appropriate responses contacted a reinforcer (25%), whereas three out of every four instances of problem behavior contacted a reinforcer (75%). Results of this study demonstrated that when implemented with full integrity (100/0), this treatment package resulted in zero instances of problem behavior and high levels of appropriate behavior. However, at lower levels of treatment integrity (i.e., 50/50), treatment efficacy was diminished in that problem behavior occurred at higher, more variable levels, and appropriate behavior occurred at lower, more variable levels, compared to when implemented with full integrity. Considering the potential undesirable side effects of extinction and its need for high treatment integrity, research should evaluate the effectiveness of behavioral interventions that do include an extinction component.

DRA without Extinction

Although DRA procedures such as FCT often include an extinction component, DRA without extinction has also reduced challenging behavior (see MacNaul & Neely, 2018 and Trump et al., 2019, for a review). In a review by MacNaul and Neely (2018), authors found that, in cases where DRA without extinction was effective, additional intervention components were in effect: the addition of a NCR component or reinforcer parameter (i.e., reinforcer schedule, quality, magnitude, or immediacy) manipulations.

DRA with Noncontingent Reinforcement

Two studies have evaluated a treatment package consisting of NCR plus DRA (Marcus & Vollmer, 1996; Roane et al., 2004) to reduce problem behavior without extinction. In a study completed by Marcus & Vollmer (1996), problem behavior was continuously reinforced, but reinforcers were also either delivered either on a fixed time (FT) schedule alone (i.e., NCR condition) or also contingent on mands (i.e., NCR plus DRA condition) for two participants (Sally and Rob). For one participant, DRA without extinction was not assessed (CJ). For Sally

and Rob, even though reinforcers were provided for problem behavior, the combination of NCR plus DRA resulted in an overall increase in mands and decrease in problem behavior. The results of the study suggest that the addition of an NCR component may be one way to mitigate the need to include an extinction component in a DRA intervention.

Roane et al. (2004) also evaluated the impact of NCR plus DRA with and without extinction on levels of problem behavior. In this study, a treatment package without an extinction component was effective in reducing problem behavior for one of the two participants. For this participant, whose problem behavior was maintained by attention, problem behavior resulted in a brief reprimand and mands were reinforced with 20 s of praise and tickles (DRA condition). After suppressing problem behavior in the DRA condition, to thin the schedule of reinforcement, access to preferred toys was added (DRA plus noncontingent toys; NCT), and mands were not reinforced during progressively increased durations (response restriction). In this study, even though problem behavior still resulted in access to attention, rates of problem behavior were lower compared to baseline in all of the treatment conditions. One limitation of this study is that although functionally equivalent, the extent of the consequence for problem behavior and appropriate behavior differed. Specifically, problem behavior received a shorter duration (i.e., smaller magnitude) of attention compared to appropriate behavior. Thus, it is possible that some of the treatment effects were due to the varying reinforcer parameters in effect.

DRA with Reinforcer Parameter Manipulations

DRA can be conceptualized as a concurrent-operant arrangement in which a specific consequence for problem behavior and another consequence for FCRs are simultaneously in effect (Ferster & Skinner, 1957). According to the matching law, when two contingencies are concurrently available, an organism will allocate responding to the behavior associated with the

more favorable reinforcement contingency (Borrero et al., 2010). Moreover, rates of responding will directly correspond to the specific difference between the two available reinforcers (e.g., generalized matching law; Baum, 1974). Matching is demonstrated when the rate of responding approximates the relative rate of reinforcement available for that response (Herrnstein, 1961). For example, in a study by Conger and Killeen (1974), authors evaluated relative rates of responding for five adult college students given two programmed schedules of reinforcement, one lean and one dense. More specifically, one confederate delivered statements of approval (i.e., reinforcers) for 70% of the student's comments (dense schedule) whereas the other confederate delivered statements of approval for only 30% of the student's comments (lean schedule). Results demonstrated that students spent more time talking to the confederate that delivered reinforcers on a dense schedule compared to the confederate delivering reinforcers on the lean schedule. Moreover, when the roles of the confederates switched, subjects "matched" the proportion of responding with the proportion of reinforcement that was delivered.

Although initial evaluations of the matching law with human subjects focused on the relative rates of reinforcement for two concurrent operants (e.g., Conger & Killeen, 1974), matching has been demonstrated to occur across other reinforcer parameters such as magnitude (e.g., McComas et al., 2008), quality (e.g., Neef et al., 1992), and immediacy (e.g., Horner & Day, 1991). Magnitude refers to the size of the reinforcer and can be conceptualized as either the amount of a reinforcer or the duration of access to a reinforcer. For example, in McComas et al. (2008), one response option resulted in receiving one point whereas the other response option resulted in two or eight points (e.g., amount). However, in Athens and Vollmer (2010) one response option resulted in 10 s of access to a reinforcer whereas the other response option resulted in 30 s of access to a reinforcer (e.g., duration of access). Quality refers to the relative

preference and reinforcing efficacy of a stimulus; therefore, quality manipulations can include different type of stimuli (e.g., edible vs. toys) or variations of the same stimulus (e.g., general vs. descriptive praise). For instance, for one of the participants, Kenneth, from a study by Athens and Vollmer (2010), one response option resulted in low-quality attention in the form of reprimands while the other response option resulted in high-quality attention in the form of praise. These stimuli were selected based on results of a preference and reinforcer assessment. Immediacy is defined as the amount of time elapsed between the emission of a target response and the delivery of a reinforcer. For example, in Athens and Vollmer (2010), one response option resulted in immediate access to a reinforcer whereas the other response option resulted in delayed access (e.g., 30 s) to a reinforcer. Although it is common practice for problem behavior to no longer produce access to reinforcers, previous studies have shown that DRA without extinction can also be effective when the intervention employed reinforcer parameter manipulations. That is, the schedule, quality, immediacy, magnitude or a combination of these, of the reinforcer delivered for problem behavior and alternative responses are adjusted to favor alternative responding.

Reinforcer Schedule. Two studies evaluated an iteration of DRA without extinction by manipulating the schedule of reinforcement for problem behavior and mands (Kelley et al., 2002; Worsdell et al., 2000). Worsdell et al. (2000) systematically thinned the schedule of reinforcer delivery for problem behavior while continuously reinforcing FCRs in order to shift responding from problem behavior to the FCR for five children that engaged in SIB. During baseline, both problem behavior and the FCR were continuously reinforced (i.e., fixed ratio 1; FR 1). During subsequent phases, each FCR resulted in access to a reinforcer, however, the schedule of reinforcer delivery for problem behavior was thinned (i.e., FR 2, FR 3, etc.) until rates of

appropriate behavior exceeded that of problem behavior. For one participant, problem behavior decreased to clinically acceptable levels during the initial baseline condition when both the FCR and problem behavior were reinforced on an FR 1 schedule. For the remaining four participants problem behavior decreased only when the schedule in effect for problem behavior was thinned to an FR 2 for one participant, an FR 3 for another, and FR 20 for the two remaining participants.

Kelley et al. (2002) also reduced problem behavior and increased appropriate behavior by manipulating the schedule of reinforcer delivery in an application of FCT without extinction. In baseline, problem behavior initially contacted reinforcer delivery on a continuous schedule but was then thinned to a variable ratio (VR) 6 or 8 schedule to mimic the rate of reinforcer delivery in the natural environment. During treatment, appropriate behavior was reinforced continuously (FR 1) while a reinforcer was delivered contingent on problem behavior on a VR schedule (VR 8). For Roger, aggression decreased, and appropriate behavior increased during acquisition and maintained during schedule thinning. For the remaining two participants problem behavior decreased only after an extinction component was introduced, but it is unknown whether longer exposure to the FCT without extinction condition would have resulted in a therapeutic effect.

Quality of Reinforcer. In four studies that evaluated DRA without extinction, the authors manipulated reinforcer quality by delivering different types of reinforcers (e.g., specified vs. randomly selected; Kahng et al., 2000; functional vs. nonfunctional; Adelinis et al., 2001; Lalli, et al., 1999; Slocum & Vollmer, 2015) for problem behavior and/or appropriate behavior. Kahng et al. (2000) manipulated the type of reinforcer delivery for problem and alternative behavior by teaching an individual two different alternative responses. In the FCT single condition, the participant was taught to emit a generalized mand, “I want treats”, that resulted in access to one of six preferred items (randomly selected). During this condition, problem behavior

also resulted in access to one of six preferred items (randomly selected). In the FCT multiple condition, the participant was taught to emit the response, “I want [specific item].” In this condition, contingent on a mand the participant was given access to the specified item and problem behavior continued to result in access to a randomly selected, one of six preferred stimuli. These alternative response contingencies can be conceptualized as different types or qualities of reinforcers because in the FCT single condition, mands resulted in one of the six different items whose relative preference may have differed, whereas in the FCT multiple condition, mands always resulted in access to the presumably most preferred item at that moment. Results demonstrated that both FCT responses initially reduced problem behavior compared to baseline levels, but only the FCT multiple response condition led to persistent decreases in problem behavior and increases in alternative responding.

Lalli et al. (1999) decreased escape-maintained problem behavior for five individuals with developmental disabilities. This study included four conditions that differed in the consequences for compliance and problem behavior. Across these conditions compliance resulted in access to edibles (i.e., non-functional) or a break (i.e., functional), and problem behavior resulting in either access to break or extinction. Overall, rates of problem behavior were lowest, and compliance was highest in the condition where compliance resulted in access to edibles and problem behavior produced a break compared to the other three conditions. Therefore, these results suggest that, at least in some cases, DRA without extinction may be effective in reducing escaped-maintained problem behavior when appropriate behavior results in a non-functional, but primary reinforcer such as edibles and problem behavior continues to result in access to the functional reinforcer, a break.

In a similar study, Adelinis et al. (2001) used DRA without extinction to decrease disruptive behavior maintained by access to attention and escape. This study differed from Lalli et al. (1999) in that the alternative behavior was a communicative response instead of compliance. Both the attention function and escape function were evaluated separately using functional (i.e., escape or attention) and non-functional (i.e., edible) reinforcers. In the treatment evaluation, appropriate communication (picture exchange) resulted in 30-s access to edibles but no eye contact. Problem behavior either resulted in a verbal reprimand (in the attention analysis) or a break (in the demand analysis). Results demonstrated that the delivery of a non-functional, edible reinforcer, contingent on appropriate communication, without implementing extinction for problem behavior, successfully reduced problem behavior and increased appropriate communication.

Finally, the study completed by Slocum and Vollmer (2015) included five individuals with developmental disabilities, three of which engaged in escape-maintained problem behavior and two whose problem behavior was multiply maintained by access to escape and tangibles. For the latter two, problem behavior was maintained by access to edibles or a leisure item. Across both treatment conditions problem behavior resulted in a 30-s break (functional reinforcer), however, in one condition compliance resulted in access to an edible (non-functional reinforcer for all but one participant) or a 30-s break (functional reinforcer). In this study, when compliance resulted in access to a break, problem behavior decreased from baseline levels for only two of the participants. Conversely, problem behavior decreased, and compliance increased for all five participants when edibles were delivered contingent on compliance.

Taken together, the results of these studies suggest that one way to increase the efficacy of DRA without extinction in treating escape-maintained problem behavior is by reinforcing

appropriate responses (i.e., mands, compliance) with a primary reinforcer. However, it is important to note that, although the relative value of edibles, attention, and break were not directly assessed in these studies, it is plausible that edibles were more reinforcing than break or attention, thus favoring appropriate responding.

Immediacy of Reinforcer. The effect of immediacy parameter manipulations in DRA without EXT was evaluated by Horner and Day (1991). Specifically, authors manipulated the amount of time that elapsed between problem behavior and the alternative behavior and the delivery of a reinforcer to reduce SIB and aggression maintained by escape. In this study, one individual was taught to exchange a break card to escape work demands. Contingent on exchange of the break card (i.e., FCR), a break was delivered immediately. However, if the individual engaged in problem behavior, a break was provided, but after a programmed delay. Authors were successful in reducing problem behavior and increasing the communication response by solely manipulating the immediacy of reinforcer delivery.

Schedule and Quality Manipulations. To decrease multiply controlled problem behavior, a couple of studies included in their DRA without EXT procedure both manipulations to reinforcer schedule and reinforcer quality (Lalli & Casey, 1996; Piazza et al., 1997). Lalli and Casey (1996) treated aggression maintained by escape from demands and access to attention for an individual with developmental delays. In the first treatment condition (escape), a 30-s break was provided contingent on problem behavior either on an FR 1 or an FR 2 schedule. In the second treatment condition (escape plus interaction), a 30-s break plus access to social interaction with the therapist was provided contingent on compliance on an initial FR 1 schedule that was later thinned to an FR 10. In both treatment conditions, problem behavior resulted in access to a 30-s break on a VR 5 schedule. Additionally, during all breaks, whether delivered

contingent on compliance or aggression, toys were available. Results demonstrated that the initial schedules of reinforcement were effective in decreasing problem behavior in the escape treatment condition, but results did not maintain when the schedule of reinforcement for compliance was thinned. When authors manipulated the quality of reinforcement (by adding therapist attention) a reduction in problem behavior and increase in compliance was observed and maintained during schedule thinning.

Piazza et al. (1997) also manipulated quality by adding functional reinforcers to the compliance contingency while problem behavior still produced access to a 30-s break. In the first evaluation (praise/break), compliance resulted in praise from the therapist. During the second evaluation (break/break), compliance resulted in a 30-s break. In the third evaluation (tangible/break), compliance resulted in 30-s access to a tangible item, which was also naturally a break from demands. During all three evaluations, the schedule for reinforcer delivery for both problem and appropriate behavior was an FR 1. In this study the DRA procedure in which compliance resulted in multiple reinforcers (i.e., break plus tangibles) and problem behavior resulted in a single reinforcer (i.e., break) was effective in reducing problem behavior and increasing compliance for two out of three participants; however, problem behavior increased when the schedule of reinforcement for compliance was thinned, thus an extinction component was also added. For one participant, the intervention did not decrease problem behavior to therapeutic levels until extinction was implemented and every instance of compliance was reinforced. Results of this study suggest DRA without extinction may initially be effective when quality of reinforcement is manipulated, but that extinction may be necessary during schedule thinning. However, given the results of Lalli and Casey (1996), it is possible that low levels of

problem behavior would be maintained, without the need for the extinction component, if schedules of reinforcement were also manipulated during schedule thinning.

Quality, Magnitude, and Immediacy Manipulations. Three studies evaluating DRA without EXT manipulated the quality, magnitude, and/or immediacy reinforcer parameters to favor appropriate behavior while still delivering reinforcers contingent on problem behavior (Athens & Vollmer, 2010; Briggs et al., 2019; Kunnavatana et al., 2018). Briggs et al. (2019) treated escape-maintained problem behavior by manipulating the quality and magnitude of reinforcement to favor alternative behavior for four individuals with disabilities. In this study, authors compared several treatment conditions including equated consequences, magnitude manipulation, quality manipulation, combined manipulation, and enhanced combined manipulation. In the equated consequences condition, both problem behavior and compliance resulted in a 30-s break. For all other manipulations, problem behavior always resulted in a 30-s break. In the magnitude manipulation, compliance contacted a 2-min break. In the quality manipulation, compliance contacted 30-s break plus access to a highly preferred item. In the combined manipulation, compliance contacted a 2-min break plus access to highly preferred stimuli and in the enhanced combined manipulation, the break was increased to four minutes. Results demonstrated that quality manipulations alone were effective at reducing problem behavior for two of the four participants and the combination of quality and magnitude manipulations were effective for the other two participants. The equated consequence and magnitude manipulation conditions were ineffective at increasing compliance. Authors note that combining magnitude and quality for compliance was necessary to maintain treatment effects following schedule thinning. This supports previous research that modifications are necessary for

DRA without extinction to be effective and that quality may be effective in shifting behavior toward compliance, but additional components are necessary for successful schedule thinning.

Similar to Briggs et al. (2019), Athens & Vollmer (2010) conducted four experiments in which reinforcer parameters were manipulated in isolation and in combination to evaluate the effectiveness of DRA without extinction. Experiments one through three measured participants' responding when one reinforcer parameter (i.e., quality, duration [i.e., magnitude], or delay) favored appropriate behavior and problem behavior still produced access to a reinforcer. In the duration (i.e., magnitude) analysis, problem behavior resulted in a smaller magnitude of the reinforcer (10 s/ 5 s access) compared to appropriate behavior (30 s/ 45 s access). The initial magnitude values were chosen based off a 1:6 ratio. For both participants, problem behavior decreased, and appropriate behavior increased, suggesting a sensitivity to the magnitude of a reinforcer.

In the quality analysis, problem behavior contacted a low-quality reinforcer and appropriate behavior contacted a high-quality reinforcer. The quality of the reinforcer was determined by conducting a preference assessment and a reinforcer assessment for the participant with problem behavior maintained by attention and a pre-session MSWO was completed for the participant with escape-maintained problem behavior. For the participant with escape-maintained problem behavior, the high-quality reinforcer included a 30-s break with access to a highly preferred item whereas the low-quality reinforcer included 30-s escape plus access to a low-quality item. For both participants, a therapeutic effect was not observed when only one high quality stimulus and one low quality stimulus were delivered for each contingency, possibly due to satiation. Therefore, authors modified this condition such that appropriate behavior contacted even higher quality reinforcement contingencies. For example, one of the participants, Kenneth,

instead of receiving praise only, he received praise plus tickles and hugs. For the other participant, Justin, instead of receiving a break plus access to one highly preferred toy contingent on appropriate behavior, he was given access to three highly preferred toys.

The third experiment was the delay analysis. In the delay analysis, problem behavior contacted a reinforcer after a delay (30 s or 60 s) while appropriate behavior contacted a reinforcer immediately. For both participants, delays to reinforcers following inappropriate behavior and immediate reinforcers following appropriate behavior shifted response allocation toward appropriate responding, suggesting individual sensitivities to delay.

In the fourth experiment, duration, quality, and delay were all manipulated to favor appropriate behavior. For example, problem behavior resulted in delayed access to a low-quality reinforcer for a small magnitude while appropriate behavior was immediately reinforced with a high-quality, high-magnitude reinforcer. Overall, the most rapid and clearly differentiated patterns of responding were observed during experiment four in which all three reinforcer parameters were manipulated to favor appropriate behavior.

One limitation to the study completed by Athens and Vollmer (2010) is that problem behavior and appropriate behavior had to occur in order for the authors to observe sensitivities to each individual reinforcer parameter (i.e., experiments 1-3). This limitation was addressed in a recent study by Kunnavatana et al. (2018) by including parameter sensitivity assessments based on arbitrary responses analogous to problem behavior to inform the treatment evaluation. Kunnavatana et al. (2018) introduced parameter sensitivity assessments which allows for reinforcer parameter sensitivities to be measured based on a concurrent-operant arrangement. Two sensitivity assessments were conducted, individual and relative. In the individual parameter sensitivity assessment, participants engaged in arbitrary responses (i.e., switch pressing) each

associated with a different reinforcement contingency. In order to measure individual sensitivities to each parameter, each parameter was pinned against itself. For example, to measure sensitivity to quality, one response was associated with a high-quality reinforcer while the other was associated with access to a low-quality reinforcer. This was done for quality, magnitude, and delay. Two of the three participants were sensitive to each individual parameter and allocated responding toward the response associated with the higher quality, larger magnitude, or more immediate reinforcer. One participant, Rufus, was sensitive only to the quality of a reinforcer. During the magnitude and immediacy sensitivity assessments, responding was variable and favored the response associated with either delayed reinforcer delivery or the smaller magnitude reinforcer. Authors note that this may have occurred simply due to an insensitivity to these parameters, or a potential color or position bias.

For the relative parameter sensitivity assessment, authors pinned two parameters against each other to identify which parameter each participant was most and least sensitive to. For example, to measure quality versus delay, one response was associated with a high-quality reinforcer delivered after a delay while the other was associated with a low-quality reinforcer delivered immediately. If response allocation favored the choice with the high-quality reinforcer, a conclusion could be made that an individual is more sensitive to quality than to delay. Conversely, if responding favored the response associated with a low-quality reinforcer delivered immediately, a conclusion could be made that the individual is more sensitive to immediacy than the quality of the reinforcer. By running all permutations of each parameter, conclusions were drawn about which parameter each individual was most sensitive to.

Following the completion of the individual and relative parameter sensitivity assessments, a treatment evaluation component was implemented to compare rates of responding

for appropriate behavior and problem behavior when the most sensitive reinforcer parameter (i.e., quality for all three participants) was manipulated versus the least sensitive reinforcer parameter (i.e., magnitude). Results of the treatment analysis indicate that DRA without extinction was effective at reducing problem behavior compared to baseline for all participants. In regard to increasing the communication response, when magnitude was manipulated, only one out of three participants engaged in higher levels of responding compared to baseline. When quality was manipulated, rates of communication increased compared to baseline for all participants with high levels of communication observed for two participants and moderate levels of communication observed for one participant. Kunnavatana et al. (2018) extends results of Athens and Vollmer (2010) by the inclusion of an arbitrary response to measure sensitivities to reinforcer parameters, assessing for sensitivities prior to treatment evaluation, and using the results of those assessments to inform the DRA without extinction treatment component.

Taken together, Athens and Vollmer (2010) and Kunnavatana et al. (2018) provide preliminary support for the use of parameter manipulations to implement DRA without extinction. However, a limitation to both studies is that the initial values programmed for the magnitude (10 s and 30 s; Athens & Vollmer, 2010; 15 s and 90 s; Kunnavatana et al., 2018) and delay (0-s and 30-s delay; Athens and Vollmer, 2010; 0-s and 10-, 280-, or 136-s delay, Kunnavatana et al., 2018) contingencies were not appropriate. That is, these did not result in a shift in response allocation. This may have been the case because neither of these studies employed individualized magnitude values or because the method employed to identify delay values (i.e., median IRT from the FA; Kunnavatana et al.) did not result in the selection of adequate values for each participant. Furthermore, as noted by Kunnavatana et al., one of the participants (Rufus) habituated to the high-quality reinforcer thus, to attain therapeutic effects,

additional reinforcers had to be added to the contingency for appropriate behavior. It is possible that the addition of frequent preference assessments could have mitigated the habituation (i.e., satiation) effect observed with this participant.

Given the promising results of the studies completed by Athens and Vollmer (2010) and Kunnavatana et al. (2018), the current study sought to extend their findings by replicating the procedures of Kunnavatana et al. (2018) while also addressing the limitations outlined above. The purpose of the current study was to evaluate the relative efficacy and efficiency of two variations of FCT without EXT designed according to the results of the relative parameter sensitivity assessments to reduce problem behavior and increase communication responses for individuals with ASD. The current study employed stimulus magnitude and delay value sensitivity assessments to identify optimal magnitude and delay values for each participant's relative parameter sensitivity assessment and also conducted frequent preference assessments to decrease potential satiation to the available reinforcers.

CHAPTER TWO:

METHOD

Participants and Settings

Four individuals participated in the study: Roberto, Dominick, Maggie, and Leo. All participants were diagnosed with ASD and engaged in problem behavior that was reported by their caregiver to be of concern. Ages ranged from two years to 10 years old. Roberto was a four-year-old male, Dominick was a two-year-old male, Maggie was a two-year-old female, and Leo was a 10-year-old male. All sessions were conducted in the participant's home. Specifically, sessions took place in the living room, bedroom, living room, and in an outside enclosed area for Roberto, Dominick, Maggie, and Leo, respectively.

Materials included hand-held devices (i.e., cell phone) with the data collection application, Countee[®], paper and pen, and stimuli used as reinforcers. A video camera was also present as sessions were recorded for IOA and data analysis purposes.

Response Definitions

The primary dependent measures were stimulus selection, problem behavior, and appropriate communication. *Stimulus selection* consisted of the participant pointing to or making physical contact (i.e., open hand; isolated finger) with an available stimulus. *Problem behavior* was individually defined for each participant. Roberto's target problem behavior was aggression which was defined as forceful contact (i.e., at least 6 in. away) between his open or closed hand

or foot and another individual's body. Dominick's target problem behavior was aggression that consisted of grasping a piece of another person's clothing or a body part and pulling the person towards him with enough force that it would move the item of clothing or body part more than 1-in. Maggie's target problem behavior was screaming. Screaming was defined as any high pitch non-contextual vocalization above conversational volume. Therefore, it excluded vocalizations such as "Yay!", "Blast off!", or other noises that occurred at a loud volume while playing with a preferred item. Leo's target problem behavior was biting. Biting was defined as opening and closing his mouth on his own or another individual's skin. *Appropriate communication* consisted of a functional (i.e., context appropriate) communication response (FCR) independent of its topography. Both Roberto's and Maggie's FCR consisted of a vocal verbal response, "My turn please." The FCR for both Dominick and Leo consisted of picking up a card and placing the card in the therapist's hand. For Dominick, the card contained the words, "I want toys" on it and Leo's card stated "BREAK" on it.

Measurement

Stimulus selection was reported as percentage of opportunities. These data were calculated by dividing the number of times an item was selected or a switch was pressed, by the total amount of times it was available during that session and multiplying by 100. *Problem behavior* was measured as frequency and then converted to rate. The rate of problem behavior was calculated by dividing the number of occurrences by the total duration of the session in minutes and multiplying by 100. *Appropriate communication* was categorized as either *prompted* or *independent* responses. Prompted appropriate communication was defined as responses emitted after a prompt was provided by the researcher whereas independent appropriate communication were those emitted in the absence of any prompts from the researcher. In

addition, *errors*, which consisted of the participant emitting a response other than the target communicative response (i.e., throwing the picture card or pushing the communication device off the table), were measured. Prompts were only used during FCT training and no errors occurred during the FCT evaluation therefore only data on independent FCR are reported for the FCT evaluation. We measured the frequency of independent FCRs and converted to rate as previously described. Data were collected by trained research assistants using a scoring software, Countee[®], or by paper and pen data sheets.

Interobserver Agreement

Selection and *switch pressing* data from the primary and secondary observer were compared on a trial-by-trial basis. Agreement was calculated as number of trials agreed upon, divided by the total number of trials per session, and multiplied by 100. For *problem behavior* and *appropriate communication*, proportional agreement was calculated by dividing the session into intervals (i.e., 10-s intervals), dividing the smallest duration/frequency during that interval by the largest duration/frequency during that interval, then adding agreements for all of the intervals and multiplying by 100. Interobserver agreement was collected for an average of 47.5% (range, 25% to 100%) of sessions across participants. Interobserver agreement for each participant was an average of 98.3% (range, 87.9% to 100%), 99.5% (range, 98.3% to 100%), 97.2% (range, 90% to 100%), and 99.6% (range, 98.5% to 100%) for Roberto, Dominick, Maggie, and Leo, respectively. IOA was collected for at least 25% of sessions within each phase and condition for each participant and was above 80% to meet *What Works Clearinghouse Design Standards* (WWC) for single-case designs (Design Standard #2A-C; Kratochwill et al., 2010).

Treatment Integrity

To assess treatment integrity, a trained observer used a checklist to determine whether the researcher correctly implemented the procedures for each phase (see Appendices B, D, E, F, G, & H). Treatment integrity was collected for an average of 43.6% (range, 25% to 100%) of sessions for all participants. Treatment integrity for each participant was an average of 99.5% (range, 98.3% to 100%), 98.4% (range, 94% to 100%), 99.7% (range, 94.3% to 100%), and 99.8% (range, 98.8% to 100%) for Roberto, Dominick, Maggie, and Leo, respectively.

General Procedure

A multielement experimental design was used for the functional analysis and a reversal design was used for the stimulus magnitude preference assessment, the delay value preference assessment, the relative parameter sensitivity assessments, and the FCT evaluation. During the FCT evaluation, the sequence of conditions were counterbalanced across participants. One participant, Roberto, experienced the conditions in both orders to demonstrate replication within a participant.

Preference Assessments

Preference assessments were conducted for all participants to determine preference for various tangible items and colors. The format of preference assessment for each participant was determined based on clinical and/or parent input regarding previous formats used and each participant's session behavior and scanning skills. For Roberto, Maggie, and Leo, a paired-stimulus (PS, Fisher et al., 1992) preference assessment was used. Initially, Dominick engaged in high rates of problem behavior when access to a preferred item (iPad) was terminated. Therefore, a restricted operant preference assessment (Hanley et al., 2003) was used for the initial

preference assessment. After the initial preference assessment, functional analysis, and the stimulus magnitude preference assessment, Dominick indicated (i.e., willingness to enter room with researcher, following one-step instructions) habituation to the presence of the researcher in the home and that instructional control was achieved (Baron & Galizio, 1983). Before the second preference assessment, the therapist provided short instructions for the session procedures (e.g., “Now we are going to play with different things and you can have the iPad when we are done”) and attempted to conduct a preference assessment using a PS format. Given that during this assessment Dominick was able to tolerate short periods of denied access to preferred stimuli, a PS preference assessment format (Fisher et al., 1992) was used during all subsequent preference assessments. We conducted preference assessments prior to any assessment or treatment evaluation condition that manipulated the quality of a reinforcer to ensure that the highest and lowest quality items were being manipulated. We classified an item as low-quality if it was selected least once during the preference assessment, but on 30% or fewer trials. In addition, high-quality items were stimuli that were selected the most amount of opportunities and in at least 70% of opportunities during the preference assessment. Stimuli identified as high and low-quality reinforcers for all participants are reported in Table 1.

The color preference assessment was conducted in a PS format to identify neutral colors (i.e., neither preferred nor non-preferred) to be used in the relative parameter sensitivity assessments. Red and green colors were omitted from the color preference assessment because these often are paired with reinforcers and/or timeout from reinforcement. Once the preference assessment was completed, we eliminated the most preferred and least preferred colors for each participant. The remaining six cards included in the rank order were used as the arbitrary stimulus targets for the parameter sensitivity assessments.

Reinforcer Assessment

A concurrent-operant reinforcer assessment was conducted to evaluate the reinforcing efficacy of each stimulus identified in the preference assessment as high preferred (HP) and low preferred (LP). The procedures for the reinforcer assessment were based on those described by Wolfe et al. (2018). During the evaluation, three sets of materials needed to complete the free-operant tasks were spaced 2 m apart on a table or the floor. For Roberto, the free operant task consisted of shirt folding and target touching was used as the free-operant response for Dominick, Maggie, and Leo. Each was associated with a different consequence (i.e., low ranked item, high ranked item, extinction). To facilitate discrimination of the contingencies associated with each set of materials, the object of the available consequence was placed directly behind the response materials. For Roberto, an iPad was used as the HP stimulus and a balloon was used as the LP stimulus for the initial reinforcer assessment. During the treatment evaluation, we conducted a new preference assessment and results indicated that Roberto's LP stimulus changed to a squish ball as he did not choose the balloon on any of the trials. An additional reinforcer assessment was conducted to ensure reinforcing efficacy of the newly identified LP item. For all of Roberto's reinforcer assessments, preference corresponded to reinforcing efficacy. For Dominick, the HP item was an iPad and the LP item was a toy with removable letters (i.e., letters toy). Prior to the treatment evaluation, we conducted a new preference assessment and results indicated that Dominick's HP stimulus changed to a sensory needle toy. An additional reinforcer assessment was conducted to ensure reinforcing efficacy of the newly identified HP item. For Maggie, her HP item was bubbles and the LP item was a toy guitar. Leo's HP item was an iPad and his LP item was a balloon. For Dominick, Maggie, and Leo, the preferred stimuli corresponded to reinforcing efficacy. That is, they responded more for the HP and LP items

compared to extinction during the reinforcer assessment and engaged in a higher rate of responding for the HP item compared to the LP item.

Prior to beginning each reinforcer assessment session, the therapist completed exposure trials by physically prompting the participant to complete the free-operant response (i.e., shirt folding for Roberto and target touching for Dominick, Maggie, and Leo) two times with each set of materials and delivering the corresponding consequence. After the exposure trials were complete, the reinforcer session began with a vocal instruction from the therapist, “work for what you want.” Every instance of the free-operant response resulted in 30 s of access to the stimulus selected, or no consequence in the case of extinction. All reinforcer assessment sessions were 2 min, excluding reinforcement intervals (i.e., the session timer will be paused during reinforcement delivery). Reinforcer assessment sessions continued until a stable trend was identified for one stimulus. An item was deemed high-quality or low-quality if the preferred item corresponded to a differentiated rate of responding during the reinforcer assessment (i.e., more responding for high-preferred item compared to low-preferred item, and more responding for both stimuli compared to extinction). All high- and low-quality reinforcers used in the sensitivity assessments and the treatment evaluation are reported in Table 1. The stimuli used in all assessments and the treatment evaluation were identified to be preferred (either high or low) and to function as reinforcers (i.e., high-quality and low-quality).

Functional Analysis

Prior to conducting the functional analysis, a brief interview was completed with the participant’s caregiver to collect information about the participant. For all participants, the interview was conducted with their mother. The interview consisted of the Functional Analysis Screening Tool (FAST; Iwata et al., 2013) as well as additional questions about the participant’s

preferred items and schedule availability (see appendix B). Then, we conducted a functional analysis (Iwata et al., 1982/1994) to identify the function(s) of each participant's problem behavior. All functional analyses included an attention, control, and demand condition. In the case of problem behavior that may have an automatic function, no interaction sessions were also included (i.e., Maggie). In addition, if the information attained during the FAST suggested that problem behavior may be maintained by access to tangible items, then a tangible condition was also included. This was the case for all participants; thus, all functional analyses included a tangible condition.

Attention: At the beginning of each session the researcher provided the participant with access to low to moderately preferred leisure items and informed them that the researcher had work to do. Items used in this condition consisted of a balloon, letter toy, guitar, and balloon for Roberto, Dominick, Maggie, and Leo, respectively. If the participant emitted an appropriate response, the researcher acted as if behavior has not occurred. If the participant engaged in the target behavior, the researcher made statements of concern (e.g., "Are you okay?"; "Don't do that, you'll hurt yourself") and provided the participant with brief physical contact. If the participant emitted any other response, the researcher acted as if the behavior did not occur.

Control: At the beginning of each session the researcher provided the participant with preferred leisure items that were within reach of the participant. These items consisted of an iPad and balloon for Roberto, an iPad and letters toy for Dominick, bubbles and a guitar for Maggie, and an iPad and balloon for Leo. The researcher then stated, "You can do whatever you want, play, or hangout." The researcher provided brief social and physical interaction at least once every 30 s or more frequently if initiated by the participant. If problem behavior occurred when social attention should have been delivered, attention was delayed until the participant did not

emit the problem behavior for 5-10 s. No consequences were provided for problem behavior.

Tangible: In this condition, prior to each session, the researcher provided the participant with 30 s of access to his/her highly preferred tangible item. These items consisted of an iPad for Roberto, Dominick, and Leo. For Maggie, bubbles were used during this condition. At the onset of each session the researcher removed access to the highly preferred item but kept the item(s) within view but out of reach of the participant. Attention (i.e., brief verbal statements such as “that’s a nice shirt”) were delivered once every 30 s. Problem behavior resulted in 30-s access to the tangible item. There were no programmed consequences for all other responses.

Demand: The researcher began each session by presenting four to five tasks (identified through parent/ caregiver interview; see appendix B) for the participant to complete. For Roberto, Dominick, and Maggie, these tasks consisted of one-step instructions (e.g., touch your head, draw a circle, stand up). For Leo, tasks consisted of reading various sight words. Each task was rotated within a session in a quasi-random sequence. During each session, the researcher continuously presented instructional trials using a three-step graduated prompting procedure (instruction, instruction paired with a model prompt, and instruction paired with a physical prompt) with a 5-s inter-prompt interval. Brief praise was provided if the participant complied with the task without requiring physical guidance (i.e., “That’s touching your head”). If the participant emitted the target problem behavior after the demand had been issued, the researcher removed all task materials and turned away for 30 s. There were no programmed consequences for all responses other than the target response and compliance.

No interaction: The session took place with the participant and the researcher in the room. No leisure items were available. There were no programmed consequences for problem behavior or appropriate behavior. The researcher remained in the room for the duration of the

session about 2.5 m away from the participant. For topographies of problem behavior that required the contact of another individual (i.e., biting, hitting, kicking), the no interaction condition was not conducted (e.g., Roberto, Dominick, and Leo).

Stimulus Magnitude Preference Assessment

The purpose of this assessment was to determine at which magnitude value preference shifts from the low magnitude to the high magnitude reinforcer. Procedures resembled a paired-stimulus preference assessment (Fisher et al., 1992). Prior to each session, two forced exposure trials were completed for each consequence. During the exposure trials the researcher provided a full physical prompt to touch a single picture card, then that consequence (i.e., reinforcer) was delivered for the corresponding magnitude value. The researcher repeated that with the other stimulus so both stimulus magnitude values were sampled. After these were completed the session began and each session consisted of 10 choice trials. During each trial, two picture cards were presented to the participant. These pictures cards showed the stimulus. The stimulus used in this assessment was an iPad for Roberto, Dominick, and Leo and bubbles for Maggie. During the first session, both options resulted in the same magnitude reinforcer for their highest preferred item and both picture cards were identical (i.e., same size, outlined in white). The participant was presented with identical pictures and selection of either picture resulted in delivery of the same reinforcer at the same magnitude. During each subsequent session, we continued to present the participant with a choice between two cards. However, the card associated with the larger magnitude reinforcer increased in size and was larger than the card associated with the small magnitude reinforcer. This was intended to help the participant discriminate between the magnitude values of the available reinforcers. The cards remained outlined in white throughout this assessment. Selection of the modified card (i.e., larger card) resulted in a greater magnitude

of that reinforcer, whereas selection of the original card (i.e., same size as initial session) resulted in the same reinforcer but at the original magnitude. The modified card (i.e., larger) was always correlated with a larger magnitude while the original card corresponded to the initial, smaller, magnitude of the reinforcer. We progressively increased the magnitude of the reinforcer by 5 s each session until the participant allocated responding toward the higher magnitude reinforcer for all 10 trials of a session. We reversed back to the initial magnitude values (i.e., 5 s and 5 s; B phase) during the subsequent session and then returned to the values associated with exclusive responding to one of the available options (second A phase). The final magnitude values were used as the high and low magnitude reinforcer values for the remainder of assessments and the treatment evaluation.

Delay Value Preference Assessment

The purpose of this assessment was to determine at which delay value preference shifts to the response option associated with immediate reinforcer delivery compared to delayed reinforcer delivery. The format of this assessment was the same as the stimulus magnitude preference assessment, but instead of increasing the magnitude value during each session, we increased the delay value associated with one response option. During all sessions, the magnitude value implemented was the terminal value identified in the stimulus magnitude preference assessment (i.e., 20, 35, 15, and 30 s for Roberto, Dominick, Maggie, and Leo, respectively). Thus, the duration of reinforcer access (i.e., magnitude) differed across participants. In the first session, both response options were associated with immediate reinforcer delivery (i.e., 0-s delay) and the stimuli were identical (i.e., white card, same size). In subsequent sessions, the delay value associated with one stimulus increased in increments of 5 s. The delay card stimulus had a red border while the stimulus card associated with immediate reinforcer delivery had a green border.

We progressively increased the delay of one reinforcer option (i.e., red card) until the participant allocated responding toward the immediately delivered reinforcer (i.e., green card) for all 10 trials of a session. After the participant exclusively chose the immediate reinforcer response option, in the next session, we reversed back to the initial delay values (i.e., 0-s and 0-s delay; B phase) and again back to the terminal delay values (second A phase). The final delay value was used as the delayed (D) reinforcer for the remainder of assessments and the treatment evaluation.

CHAPTER THREE:

STUDY ONE

Relative Parameter Sensitivity Assessment

The purpose of this assessment was to determine if the participant's behavior was more or less sensitive to each reinforcer parameter when both were available concurrently. Across all parameter sensitivity assessments, two switches (i.e., touch light covered with tissue paper), of differing colors, were available and associated with one of the consequences available (i.e., larger magnitude reinforcer; immediate reinforcer). For problem behavior maintained by escape (i.e., Leo), high quality consisted of a break plus access to highly preferred items, whereas low quality consisted of a break only. Magnitude was adjusted based on the duration of the break. See Table 2 for the specific values of the parameters evaluated for each participant.

Exposure Trials

Prior to each parameter sensitivity phase and/or research appointment we conducted six exposure trials (three for each available switch [response option]) to provide an opportunity for participants to experience the different available contingencies before assessing their sensitivity to the options available. If a phase continued into the next appointment, another six exposure trials were conducted. Exposure trials were always conducted at the beginning of a phase change. Each exposure trial consisted of the participant being presented with two switches and the researcher prompting them to touch one of the switches. The participant experienced the consequence associated with that switch (e.g., 5-s magnitude, high-quality reinforcer). On the subsequent trial, the researcher prompted the participant to touch the other switch and delivered

the corresponding consequence.

Quality vs. Magnitude

Sessions included 10 trials and a minimum of three sessions per phase. Response allocation between a high-quality, low-magnitude reinforcer and a low-quality, high-magnitude reinforcer were compared using a concurrent-chain arrangement. At the onset of the session, the researcher presented two colored switches to the participant: one associated with a high-quality, low-magnitude reinforcer and one associated with a low-quality, high-magnitude reinforcer. Contingent on a stimulus selection, the participant contacted the contingency associated with that switch.

Quality vs. Immediacy

Sessions included 10 trials and a minimum of three sessions per phase. Response allocation between a low quality, immediately available reinforcer and high quality, delayed reinforcer was compared using a concurrent-chain arrangement. At the onset of the session, the researcher presented two colored switches to the participant: one associated with a low quality, immediately available reinforcer and one associated with a high quality, delayed reinforcer. Contingent on a stimulus selection, the participant contacted the contingency associated with that switch.

Magnitude vs. Immediacy

Sessions included choice 10 trials and a minimum of three sessions were completed per phase. Response allocation between a low magnitude of an immediately available reinforcer and high magnitude of a delayed reinforcer was evaluated using a concurrent-chain arrangement. At the onset of the session, the researcher presented two colored switches to the participant: one associated with a low magnitude of an immediately available reinforcer and one associated with

a high magnitude of a delayed reinforcer. Contingent on a stimulus selection, the participant contacted the contingency associated with that switch.

CHAPTER FOUR:

STUDY TWO

Treatment Evaluation: DRA without Extinction

In the previously described section, we described procedures for assessing sensitivity to dimensions of reinforcer parameters using arbitrary responses (i.e., stimulus selections). The purpose of the intervention portion of the study was to evaluate the effects of a DRA without extinction (i.e., FCT) procedure on levels of problem behavior and appropriate communication (i.e., FCR).

Before the treatment evaluation, each participant was taught to independently emit the FCR (Table 1) because programmed consequences were in effect for both the FCR and problem behavior even during the baseline phases. To identify appropriate prompt intervals to be used during FCT training, we calculated for each participant the shortest inter-response time (IRT) for problem behavior during the FA condition that maintained problem behavior. The shortest IRT was reduced by 20% and that duration was set as the initial inter-prompt interval during FCT training. This method for selecting a prompt interval was used to minimize the likelihood of problem behavior occurring but also to increase the likelihood that the establishing operation (EO) for the functional reinforcer is in effect. For problem behavior maintained by access to tangibles (i.e., Roberto, Dominick, and Maggie), at the start of each trial the therapist removed the tangible item and turned away from the participant. For escape-maintained problem behavior (i.e., Leo), demands were placed at the beginning of each session (e.g., “Time to read”). For participants whose FCR required a tool (i.e., picture card) that item was available from the onset

of the trial. After the initial prompt delay lapsed or the participant's behavior indicated that the EO might be present (i.e., tapping therapist, attempting to leave), the therapist used a full physical prompt (i.e., Dominick and Leo) or full model prompt (i.e., Roberto and Maggie) for the participant to emit the FCR. Prompts were faded across sessions from most-to-least intrusive prompts (i.e., full prompt, partial prompt, initial sound/gesture). During training independent and prompted FCRs were continuously reinforced; that is, they resulted in access to the reinforcer each time they were emitted. Training sessions continued until the mastery criteria of at least 80% correct and independent responses across two consecutive sessions was met. All participants acquired the FCR in three or four sessions.

During the FCT evaluation, each session consisted of 10 trials (i.e., opportunities to emit either problem behavior or the FCR) and at least three sessions were completed per phase. Differing parameters of the functional reinforcer were provided on an FR 1 schedule for problem behavior and the FCR based on the results of the previous analyses. In baseline (A), contingencies favored problem behavior. For example, if the participant was most sensitive to quality and least sensitive to immediacy (i.e., Leo), during baseline, problem behavior contacted an immediate, high quality reinforcer, whereas the FCR contacted a low-quality reinforcer after a delay.

During FCT-least sensitive (FCT-LS) the least sensitive reinforcer parameter was manipulated with contingencies favoring the FCR while keeping the most sensitive parameter constant. For example, during FCT-LS for Leo, quality remained constant as both responses resulted in access to a break without access to an iPad (i.e., low quality). However, the FCR was reinforced immediately and problem behavior was reinforced after a 35-s delay (i.e., immediacy). During FCT-most sensitive (FCT-MS), the most sensitive reinforcer parameter was

manipulated with contingencies favoring the FCR while keeping the least sensitive parameter constant. For example, during FCT-MS for Leo, immediacy remained constant as both responses contacted a 35-s delay. However, the FCR was reinforced with a high-quality reinforcer (i.e., break plus iPad) and problem behavior was reinforced with a low-quality reinforcer (i.e., break). Each participant experienced both FCT conditions. If a delay was included in a contingency for either problem behavior or FCR, the delay interval was reset contingent on the occurrence of any of these responses. Moreover, the contingency delivered was according to the first response emitted (i.e., problem behavior or FCR). Thus, the reinforcer was always delivered after the programmed delay. All participant's contingencies for the FCT evaluation are depicted in Table 3.

Social Validity Measure

Upon completion of the treatment evaluation, caregivers were asked to fill out a social validity questionnaire (see Appendix J). The questionnaire included statements regarding the effectiveness and acceptability of the intervention in which caregivers answered using a Likert-type scale. Questions were modified from the social validity questionnaire used in Carroll and St. Peter (2014) and are displayed in Table 4.

Upon completion of the study, the caregiver was shown two 30-s videos. One video was from the first session of baseline and one video was from the last session of the most effective FCT condition. The video from the FCT condition was FCT-MS for Roberto and Dominick and FCT-LS for Maggie and Leo. After the videos were shown, the researcher reviewed the questionnaire with the caregiver, allowed them to ask any questions they had related to the videos or content of the questionnaire, and then provided the caregiver with a blank copy of the questionnaire and an unsealed envelope with the researcher's name and address on it. The

researcher instructed the caregiver to fill out the questionnaire, without including their names, place the completed questionnaire in the envelop, seal it, and return the completed questionnaire to the researcher during the next scheduled appointment. At the next appointment, the researcher collected the sealed, anonymously completed, social validity questionnaire. After receiving the sealed envelopes from all caregivers, the researcher opened all four envelopes in the presence of another researcher. The questionnaires were reviewed, and results were summarized.

CHAPTER FIVE:

RESULTS

Results for all participants are presented in Figures 1-9. Figure 1 depicts results of the functional analysis for Roberto, Dominick, Maggie, and Leo as responses per minute. Roberto engaged in low to zero levels of aggression during the play, attention, and demand conditions. During the tangible condition, in which aggression resulted in access to an iPad, Roberto's aggression occurred at moderate to high levels suggesting that his aggression was maintained by access to tangibles. Dominick engaged in low to zero levels of aggression during the play and demand condition. During the tangible condition, in which aggression resulted in access to an iPad, Dominick's aggression occurred at high levels, suggesting that his aggression was maintained by access to tangibles. However, slightly elevated and variable rates of responding also occurred during the attention condition, thus, an additional pairwise analysis was conducted to determine if his aggression was also maintained by access to attention. During the pairwise analysis, aggression decreased to zero levels; thus, an attention function was ruled out. Maggie engaged in low to zero levels of screaming during the attention, ignore, demand, and play conditions. During the tangible condition, in which screaming resulted in access to bubbles, high levels of screaming were observed, suggesting that Maggie's screaming was maintained by access to tangibles. Leo engaged in zero levels of biting during the, play, ignore, attention, and tangible conditions. During the demand condition, in which biting resulted in a 30-s break from demands, biting occurred at high levels suggesting that Leo engaged in biting to escape academic demands (i.e., reading a book).

Figure 2 contains the results of the stimulus magnitude preference assessment for Roberto, Dominick, Maggie, and Leo as percentage of trials in which each option was selected. During this assessment all reinforcers were delivered immediately (0-s delay) but the duration of access (i.e., magnitude) to the preferred item was manipulated. None of the participants engaged in any problem behavior during this assessment. Initially when both response options resulted in access to the iPad at the same magnitude of 5 s, Roberto chose each response option on 50% of the trials. As the magnitude associated with one of the options increased to 10, 15, and 20 s, Roberto selected the option associated with larger magnitude more often. Roberto exclusively chose the larger magnitude response option when the options available were 20 and 5 s. Similar results were observed in phase B when the same initial magnitude values (i.e., 5 s and 5 s) were in effect and in the second phase A, when the terminal differing magnitude values (i.e., 5 s and 20 s) were available. Roberto's small magnitude value was 5 s and his large magnitude value was 20 s for the remainder of assessments and the treatment evaluation.

For Dominick, when both response options resulted in access to an iPad at the same magnitude of 10 s, he chose each response option 40% and 60% of the trials. As the magnitude associated with one of the options increased, Dominick selected the option associated with the larger magnitude more often. Exclusive responding to the larger magnitude response option occurred at the values 10 s and 35 s. Similar results were observed in phase B when the same initial magnitude values (i.e., 10 s and 10 s) were in effect and in the second phase A, when the terminal differing magnitude values (i.e., 10 s and 35 s) were available. Dominick's small magnitude value was 10 s and his large magnitude value was 35 s for the remainder of assessments and the treatment evaluation.

When both response options corresponded to access to bubbles at the same magnitude (i.e., 5 s), Maggie chose each response option 40% and 60% of the trials. As the magnitude associated with one of the options increased, Maggie selected the option associated with the larger magnitude more often and she exclusively chose the larger magnitude response option at the values 5 s and 15 s. Similar results were observed in phase B when the same initial magnitude values (i.e., 5 s and 5 s) were in effect and in the second phase A, when the terminal differing magnitude values (i.e., 5 s and 15 s) were available. Therefore, 5 s was used for Maggie's small magnitude value and 15 s was used for the large magnitude value for the remainder of assessments and the treatment evaluation.

For Leo, when both response options corresponded to access to a break at the same magnitude of 5 s, Leo chose each response option on 50% of the trials. As the magnitude associated with one of the options increased to 10 s and 15 s, he continued to select each response option on 50% of the trials. However, as the magnitude value increased to a 20 and 25-s break, Leo selected the option associated with the larger magnitude more often. Leo exclusively chose the larger magnitude response option at the magnitude values of 5 s and 30 s. Similar results were observed in phase B when the same initial magnitude values (i.e., 5 s and 5 s) were in effect and in the second phase A, when the terminal differing magnitude values (i.e., 5 s and 30 s) were available. Therefore, Leo's small magnitude value was 5 s and large magnitude value was 30 s for the remainder of assessments and the treatment evaluation.

Results of the delay value sensitivity assessments are depicted in Figure 3 for all participants. Roberto, Maggie, and Leo did not engage in any problem behavior during this assessment. Initially when both response options corresponded to immediate delivery of the iPad at the same magnitude of 20 s, Roberto chose each response option on 30% and 70% of the trials.

As the delay value associated with one of the options increased to 20 s, Roberto continued to select both response options on a similar amount of trials. However, Roberto exclusively chose the response option associated with immediate reinforcer delivery (i.e., 0-s delay) when the delayed option was increased to 25 s. Similar results were observed in phase B when the same initial delay values (i.e., 0 s and 0 s) were in effect and in the second phase A, when the terminal differing delay values (i.e., 0 s and 25 s) were available. Therefore, Roberto's delay value was 25 s for the remainder of assessments.

For Dominick, when both response options corresponded to immediate access to the iPad at magnitude of 35 s, Dominick chose each response option on 50% of the trials. As the delay value associated with one of the options increased, Dominick continued to select each option at variable percentages with responding slightly favoring the 0-s delay response option. However, Dominick engaged in some problem behavior during sessions in which he chose the delayed reinforcer. Therefore, at the session with 0 s and 35 s delay values (i.e., the seventh session) a rule was introduced ("Green card, no wait). Following this session, when the delay values were 0 s and 40 s, Dominick exclusively responded to the immediately delivered reinforcer and problem behavior ceased. Similar results were observed in phase B when the same initial delay values (i.e., 0 s and 0 s) were in effect and in the second phase A, when the terminal differing delay values (i.e., 0 s and 40 s) were available. Therefore, Dominick's delay value was 40 s for the remainder of assessments and the treatment evaluation.

Maggie chose each response option on 40% and 60% of the trials when both resulted in immediate access to bubbles at the same magnitude of 15 s. As the delay value associated with one of the options increased to 5 and 10 s, Maggie chose the option associated with immediate reinforcer delivery more often and she exclusively chose the response option associated with

immediate reinforcer delivery when the options available were 0 s and 15 s. Similar results were observed in phase B when the same initial delay values (i.e., 0 s and 0 s) were in effect and in the second A phase, when the terminal differing delay values (i.e., 0 s and 15 s) were available. Therefore, Maggie's delay value was 15 s for the remainder of assessments and the treatment evaluation.

For Leo, initially when both response options corresponded to immediate delivery of a 30-s break, he chose each response option on 40% and 60% of the trials. As the delay value associated with one of the options increased from to 20 s, Leo continued to select each option at on a similar percentage of trials. Leo exclusively chose the response option associated with immediate reinforcer delivery were the option available results in 0 s or 35 s delay. Similar results were observed in phase B when the same initial delay values (i.e., 0 s and 0 s) were in effect and in the second A phase, when the terminal differing delay values (i.e., 0 s and 35 s) were available. Therefore, Leo's delay value was 35 s for the remainder of assessments and the treatment evaluation.

Results of the relative parameter sensitivity assessment are depicted in Figures 4-7. Results of Roberto's relative parameter sensitivity assessments are displayed in Figure 4. During this assessment, we compared response allocation between a high quality (HQ; iPad) but low magnitude (LM; 5 s) reinforcer and a low quality (LQ; net ball) but high magnitude (HM; 20 s) reinforcer (i.e., quality versus magnitude; top panel), a HQ (iPad) but delayed reinforcer (25-s delay) and a LQ (net ball) but immediate (0-s delay) reinforcer (i.e., quality versus immediacy; middle panel), and a LM (5 s) but immediate (0-s delay) reinforcer and a HM (20 s) but delayed (25-s delay) reinforcer (i.e., magnitude versus immediacy; bottom panel). Roberto preferred a higher quality reinforcer compared to a larger magnitude reinforcer (top panel), a higher quality

reinforcer to an immediately delivered reinforcer (middle panel), and an immediately delivered reinforcer to a larger magnitude reinforcer (lower panel). Problem behavior remained low during the quality versus magnitude and quality versus immediacy sensitivity assessments. However, elevated rates of problem behavior were observed during the immediacy versus magnitude assessment and rates of problem behavior corresponded to sessions in which the delay response option was chosen. Based on results of these assessments, we concluded that Roberto's behavior is most sensitive to the quality of reinforcer and least sensitive to the magnitude of a reinforcer.

Dominick's relative parameter sensitivity assessment results are depicted in Figure 5. During this assessment, we compared response allocation between a HQ (sensory needle toy) but LM (10 s) reinforcer and a LQ (guitar) but HM (35 s) reinforcer (i.e., quality versus magnitude; top panel); a HQ (sensory needle toy) but delayed reinforcer (40-s delay) and a LQ (guitar) but immediate (0-s delay) reinforcer (i.e., quality versus immediacy; middle panel); and a LM (10 s) but immediate (0-s delay) reinforcer and a HM (35 s) but delayed (40-s delay) reinforcer (i.e., magnitude versus immediacy; bottom panel). Dominick preferred a higher quality reinforcer compared to a larger magnitude reinforcer (top panel), an immediately delivered reinforcer to a higher quality reinforcer (middle panel), and an immediately delivered reinforcer to a larger magnitude reinforcer (bottom panel). Dominick engaged in low levels of problem behavior throughout most of the relative parameter sensitivity assessments. However, elevated rates of problem behavior were observed during initial sessions (i.e., sessions 1-4) compared to later sessions (i.e., sessions 5-7) of each assessment and when the delay option was chosen during the delay sensitivity assessments (middle and bottom panel). Based on results of these assessments, we concluded that Dominick's behavior is most sensitive to the immediacy of reinforcer delivery and is least sensitive to the magnitude of a reinforcer.

For Maggie (Figure 6), we compared response allocation between a HQ (bubbles) but LM (5 s) reinforcer and a LQ (ball) but HM (15 s) reinforcer (i.e., quality versus magnitude; top panel), a HQ (bubbles) but delayed reinforcer (15-s delay) and a LQ (ball) but immediate (0-s delay) reinforcer (i.e., quality versus immediacy; middle panel), and a LM (5 s) but immediate (0-s delay) reinforcer and a HM (15 s) but delayed (15-s delay) reinforcer (i.e., magnitude versus immediacy; bottom panel). Maggie preferred a higher quality reinforcer compared to a larger magnitude reinforcer (top panel), a higher quality reinforcer to an immediately delivered reinforcer (middle panel), and a larger magnitude reinforcer to an immediately delivered reinforcer (bottom panel). In addition, problem behavior remained low during all relative parameter sensitivity assessments with the exception of session two in the quality versus magnitude assessment (top panel). Based on results of these assessments, we concluded that Maggie's behavior is most sensitive to the quality of reinforcer and least sensitive to the immediacy of reinforcer delivery.

Leo's relative parameter sensitivity assessment results are depicted in Figure 7. During this assessment we measured response allocation between a HQ (break + iPad) but LM (5 s) reinforcer and a LQ (break) but HM (30 s) reinforcer (i.e., quality versus magnitude; top panel), a HQ (break + iPad) but delayed reinforcer (35-s delay) and a LQ (break) but immediate (0-s delay) reinforcer (i.e., quality versus immediacy; middle panel), and a LM (5 s) but immediate (0-s delay) reinforcer and a HM (30 s) but delayed (35-s delay) reinforcer (i.e., magnitude versus immediacy; bottom panel). Leo preferred a higher quality reinforcer compared to a larger magnitude reinforcer (top panel), a higher quality reinforcer to an immediately delivered reinforcer (middle panel), and a larger magnitude reinforcer to an immediately delivered reinforcer (bottom panel). Problem behavior remained low during most relative parameter

sensitivity assessments. However, rates of problem behavior were elevated when the delay option was chosen frequently (i.e., session 4 and 5 of quality versus delay assessment; sessions 1-3 of the magnitude versus delay assessment). Based on results of these assessments, we concluded that Leo's behavior is most sensitive to the quality of reinforcer and least sensitive to the immediacy of reinforcer delivery.

Results of the treatment evaluation are displayed in Figures 8 and 9 and the contingencies in effect for each participant are displayed in Table 2. Data on responses per minute of problem behavior and FCRs were used to determine the relative efficacy of the FCT-LS and FCT-MS whereas duration of sessions was used as an indicator of efficiency of the procedures. Roberto and Dominick's treatment results are shown in Figure 8 as responses per minute. Both participants engaged in problem behavior during the initial baseline phase and they seldom emitted the FCR. In addition, similar levels of problem behavior and FCR were observed during all baseline phases for both participants. During the FCT-MS condition, problem behavior decreased to low levels and both participants emitted the FCR at high levels. In the FCT-LS condition, problem behavior decreased compared to baseline and both participants emitted the FCR, however, levels of communication responses were lower than those emitted in the FCT-MS condition. This graph demonstrates that both FCT conditions were effective in reducing problem behavior and increasing the FCR, but that treatment effects were more robust in the FCT-MS condition. Furthermore, sessions in the FCT-MS condition were shorter in duration compared to the sessions in the FCT-LS condition, indicating that the FCT-MS condition was not only more effective, but more efficient than the FCT-LS condition in reducing problem behavior and increasing communication for both Roberto and Dominick.

Results of the treatment evaluation for Maggie (top panel) and Leo (bottom panel) are depicted in Figure 9 as responses per minute. Both Maggie and Leo emitted problem behavior across all sessions of both baseline phases and both emitted low to zero levels of the FCR during these sessions. In addition, both FCT conditions were effective in reducing problem behavior and increasing communication. However, for Maggie, levels of problem behavior and communication as well as session duration were similar across both FCT conditions whereas Leo emitted the FCR more often during the FCT-LS condition. Furthermore, for Leo, sessions of the FCT-LS condition were shorter in duration compared to the FCT-MS condition. These data indicate that for Maggie both FCT conditions were equally effective and efficient, but that the FCT-LS condition was most effective and efficient for Leo.

Results of the social validity assessment completed with caregivers are displayed in Table 3. The average score for all items on the questionnaire was a 4 indicating that caregivers strongly agreed with each of the item statements. Specifically, caregivers indicated that they observed a decrease in their child's challenging behavior and an increase in their child's communication. They also indicated that the intervention was appropriate given their child's age and topic of problem behavior. Furthermore, all caregivers reported that they would recommend this intervention to others.

CHAPTER SIX:

DISCUSSION

The current study used stimulus magnitude and delay value sensitivity assessments to identify optimal reinforcer magnitude and delay values for each participant. These parameter values were then used in a series of relative parameter sensitivity assessments, in which contingencies were in effect for an arbitrary response, to obtain a hierarchy of relevant reinforcer parameters. These assessments were completed using a concurrent-operant arrangement. Once each participant's most and least sensitive reinforcer parameter was identified, two iterations of FCT without extinction were designed and their effect was evaluated based on the rate of problem behavior and functional communication responses. In the current study both FCT procedures were effective in reducing problem behavior and increasing FCRs, thus indicating that the parameter sensitivity assessments were effective at identifying relevant reinforcer parameters for each participant. Moreover, the FCT-MS condition was most effective and more efficient than the FCT-LS condition for two out of four participants.

Results of the current study are consistent with findings from previous literature in many ways. For instance, during the baseline phase of the FCT evaluation contingencies favored problem behavior as problem behavior resulted in high quality, high magnitude, or immediate reinforcer delivery while the FCR contacted low quality, low magnitude, or delayed reinforcement. As such, all participants engaged in high rates of problem behavior and low to zero levels of the FCR during baseline. However, during the FCT phase, contingencies favored the FCR and all participants engaged in higher rates of the FCR compared to problem behavior.

The shift in response allocation from problem behavior to FCRs abides by the matching law which proposes that individuals will allocate more responding to the response option associated with more reinforcement (Borrero et al., 2010).

In addition, our results are similar to those of recent research showing that FCT without extinction is effective in reducing problem behavior and increasing communication when reinforcer parameters are adjusted to favor appropriate responses (e.g., Athens & Vollmer, 2010; Briggs et al., 2019; Kunnavatana et al., 2018; Slocum & Vollmer, 2015). However, our procedures and results differ from these studies in a few ways. First, in our study, FCT without extinction was effective for all participants even though a single reinforcer parameter was manipulated. Conversely, in the study completed by Athens and Vollmer, for the three participants for whom a single parameter was manipulated (i.e., Justin, Lana, and Kenneth), FCT without extinction was not effective. Moreover, Briggs et al. found that when only one parameter (i.e., quality) was manipulated, problem behavior decreased for two of four participants. Second, in the current study, both FCT-LS and FCT-MS were effective in reducing problem behavior and increasing communication, whereas in the study completed by Kunnavatana et al., better treatment effects were attained when the most sensitive parameter was manipulated. Specifically, in that study when only the least sensitive reinforcer parameter, magnitude, was manipulated, problem behavior decreased for all participants, but an immediate change in the level for appropriate responding occurred for only one participant (i.e., Max). When the most sensitive parameter, quality, was manipulated, communication increased for all participants and an immediate change in level was observed for two of three participants (i.e., Sabrina and Max). The variables responsible for these inconsistent results is unclear, but may include participants' characteristics (e.g., diagnosis, function of problem behavior, history of reinforcement for problem behavior) as

well as differing procedures employed to identify reinforcer parameter values (e.g., IRT vs. stimulus magnitude and delay value sensitivity assessments). Furthermore, given that in the current study both iterations of FCT evaluated were effective, it is possible that, at least for some individuals, an FCT without extinction procedure in which two arbitrarily selected parameters (e.g., quality and magnitude) are manipulated would produce similar therapeutic effects. Future studies should attempt to identify participant characteristics that are predictors of treatment efficacy.

The results of this study are also consistent with previous studies implementing DRA without extinction using parameter manipulations to treat escape-maintained problem behavior (Briggs et al., 2019; Slocum & Vollmer, 2015) and multiply controlled problem behavior (i.e., escape plus tangible; Slocum & Vollmer, 2015). In these studies when compliance resulted in a break plus access to preferred items (Briggs et al, 2019) or edibles (Slocum & Vollmer), compliance increased and problem behavior decreased. In the current study, when Leo had access to a 30-s break plus access to an iPad contingent on the FCR, problem behavior decreased and appropriate responses increased. Furthermore, Briggs et al. suggest the use of a discriminative stimulus to enhance the signalling of various break-magnitudes. In the current study, during FCT-MS for Leo, the FCR resulted in a 30-s break after a 30-s delay. We used a dynamic visual timer to signal the duration of the break and were successful at suppressing problem behavior during delay to reinforcement intervals.

This study extends previous research on individual parameter assessments by replacing the individual parameter sensitivity assessments used in Kunnavatana et al. (2018) with stimulus magnitude and delay value sensitivity assessments to determine the initial programmed values for each participant. This systematic evaluation allowed us to identify appropriate reinforcer

magnitude and delay values for each participant instead of using arbitrarily selected values (e.g., 1:6 magnitude ratio; Athens & Vollmer, 2010; Kunnavatana et al., 2018) or selecting a value based on responding during the functional analysis (e.g., two times the median inter-response time; Kunnavatana et al., 2018) as well as ensuring that each participant was sensitive to each parameter in isolation. In addition, given that our study employed a systematic method for identifying optimal reinforcer parameter values for each participant, we likely prevented the need to adjust the parameter values during the subsequent treatment evaluation or sensitivity assessments, as was necessary in previous research (e.g., Athens & Vollmer, 2010; Kunnavatana et al., 2018). Moreover, the inclusion of these assessments allowed us to increase the efficiency of our procedures by minimizing session duration because in the current study, the largest reinforcer magnitude and longest delay interval was 35 s and 40 s, respectively. In comparison, in previous studies the largest magnitude values were 45 s and 180 s and the longest delay values were 60 s and 280 s in Athens & Vollmer (2010) and Kunnavatana et al. (2018), respectively.

Both Kunnavatana et al. (2018) and the current study employed a tracking test where the color of the stimuli that corresponded to a certain contingency were switched (referred to as contingency reversal in the current study). However, Kunnavatana et al. did not conduct a color preference assessment prior to selecting the colors used for the arbitrary stimuli. Thus, a color bias may explain why one participant, Rufus, did not track the contingencies (i.e., responding did not shift when the contingencies were reversed) during the tracking test. Therefore, in the current study, we conducted a color preference assessment and used colors of medium preference to be associated with each arbitrary stimulus. All participants tracked the contingencies during the contingency reversal, with the exception of Roberto's first B phase in the quality versus magnitude parameter sensitivity assessment, indicating that the inclusion of the color preference

assessment may have mitigated any color biases. Additionally, to minimize the possibility of satiation impacting the quality of the reinforcers, and thus decreasing the efficacy of FCT, the current study conducted preference assessments prior to every quality manipulation (e.g., quality versus magnitude, quality versus delay, FCT). By conducting preference assessments often, we captured shifts in preference over time and ensured that when the quality of a reinforcer was manipulated, the most relevant stimulus was utilized.

One limitation of Athens and Vollmer (2010) that was the programmed and obtained schedules of reinforcement differed. Specifically, additional problem behavior that occurred during the delay interval did not extend the delay to reinforcement. Thus, problem behavior could occur during the delay interval and that response could result in immediate access to a reinforcer (i.e., adventitious reinforcement may have occurred). To address this issue, the current study reset the programmed delay interval contingent on the occurrence of target responses during the delay. That is, contingent on the occurrence of one of the target responses (i.e., problem behavior or FCR) the corresponding delay interval began and if additional problem behavior or FCRs were emitted during the delay interval, the delay interval reset. Therefore, the programmed and obtained schedules of reinforcement were the same. Although a resetting delay interval was employed in this study to mitigate the possibility of adventitious reinforcement, as suggested by Athens and Vollmer (2010), a changeover delay (COD) may be another way to control for this effect.

Even though both FCT procedures evaluated in this study were effective, the procedures employed in this study do have some limitations. First, we chose to reset the delay interval to ensure that the programmed and obtained schedule of reinforcement were the same. However, this procedure extended duration of sessions, at least initially, when participants emitted various

responses during the delay interval. The addition of a dynamic visual timer and rule (i.e., “Today, we have to wait”) decreased the occurrence of these responses as sessions progressed, but it should be noted that Leo had previous experience with visual timers whereas Maggie and Dominick did not. This led to higher rates of responding during the delay interval for Maggie and Dominick compared to Leo. Future research may consider conducting a multiple schedule with visual timers prior to evaluating FCT to minimize the occurrence of responses during the delay interval. Alternatively, future studies may want to consider multiple data analyses, one that includes responses throughout the entire session (i.e., including delay intervals) and one that omits responding during the delay interval in order to make the comparison of rate across conditions and participants equivalent. Furthermore, for participants with delay intervals imposed for both problem behavior and the FCR during one FCT condition and not the other, session durations of the FCT conditions that included a delay were longer and naturally reflected lower rates of responding for each target response. For example, with Leo, in the FCT-MS condition, both problem behavior and the FCR contacted a 35-s delay. In the FCT-LS condition, only problem behavior contacted a delay while the FCR was delivered immediately. Therefore, even if all responding was allocated to the FCR in both the FCT-MS and FCT-LS condition, rates of responding would be higher in the FCT-LS condition due to the consequence in effect for the FCR (i.e., low quality/ immediate reinforcer delivery). Therefore, response rate should not be the only index of treatment efficacy.

Another limitation to this study is a lack of generalization and maintenance data. In Athens and Vollmer (2010), authors trained the participant’s teachers on the intervention procedures and had them implement the intervention during a 2-month follow-up. It would be beneficial for future studies to evaluate whether the FCT-MS and FCT-LS conditions could be

implemented by other individuals such as caregivers or teachers to promote long term maintenance and generalization of treatment results. Finally, the current study did not evaluate these procedures for individuals with problem behavior maintained by access to attention. Athens and Vollmer (2010) included one individual with attention-maintained problem behavior (Kenneth), but only in the quality analysis (i.e., experiment two). Therefore, future studies should implement these procedures with individuals who have attention-maintained problem behavior to evaluate the efficacy of this intervention for that population.

In conclusion, this study demonstrated that FCT without extinction designed based on results of relative parameter sensitivities, was effective in reducing problem behavior and increasing functional communication for four participants. Additionally, the inclusion of the magnitude and delay value sensitivity assessments allowed for precise treatment programming and could be used to inform future studies evaluating DRA without extinction. Taken together, results of the current study extend findings of previous research and support the use of FCT without extinction to reduce severe problem behavior through use of parameter manipulations.

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APPENDICES

Appendix A

Tables

Table 1 *Participant Information*

| Participant | Age (yrs) | PB | Function of PB | FCR | High Quality Reinforcer | Low Quality Reinforcer |
|-------------|-----------|------------|----------------|---|-------------------------|-------------------------|
| Roberto | 4 | Aggression | Tangible | Vocal verbal: “My turn please.” | iPad | Squish Ball/ Balloon |
| Dominick | 2 | Pulling | Tangible | Picture card exchange: “I want toys.” | Sensory Needles | Letters |
| Maggie | 2 | Screaming | Tangible | Vocal verbal: “My turn please.” | Bubbles | Guitar |
| Leo | 10 | Biting | Escape | Picture card exchange: “BREAK” | Break + iPad | Break |

Table 2 *All Participant's Relative Parameter Sensitivity Assessment Contingencies*

| Participants | Quality v. Magnitude | Quality v. Immediacy | Magnitude v. Immediacy |
|--------------|---|--|---|
| Roberto | iPad (5-s mag) v. Balloon (20-s mag); 0-s delay for both | iPad (25-s delay) v. Balloon (0-s delay); 20-s mag for both | 5-s mag (0-s delay) v. 20-s mag (25-s delay); iPad for both |
| Dominick | iPad (10-s mag) v. Letters toy (35-s mag); 0-s delay for both | iPad (40-s delay) v. Letters toy (0-delay); 35-s mag for both | 10-s mag (0-s delay) v. 35-s mag (40-s delay); iPad for both |
| Maggie | Bubbles (5-s mag) v. Ball (15-s mag); 0-s delay for both | Bubbles (15-s delay) v. Ball (0-s delay); 15-s mag for both | 5-s mag (0-s delay) v. 15-s mag (15-s delay); Bubbles for both |
| Leo | Break + iPad (5-s mag) v. iPad (30-s mag); 0-s delay for both | Break + iPad (35-s delay) v. iPad (0-s delay); 30-s mag for both | 5-s mag (0-s delay) v. 30-s mag (35-s delay); Break + iPad for both |

Note. Mag= magnitude

Table 3 All Participant's FCT Evaluation Contingencies

| Participant | Reinforcer Parameters | Conditions | PB Contingency | FCR Contingency |
|-------------|--------------------------------|------------|-----------------------------------|---|
| Roberto | MS= Quality LS= Magnitude | BL | HQ (iPad)/ HM (20 s) | LQ (net ball)/ LM (5 s) |
| | | FCT- LS | LQ (net ball)/ LM (5 s) | LQ (net ball)/ HM (20 s) |
| | | FCT- MS | LQ (net ball)/ LM (5 s) | HQ (iPad)/ LM (5 s) |
| Dominick | MS= Immediacy LS= Magnitude | BL | HM (35 s)/ I (0 s) | LM (10 s)/ D (40 s) |
| | | FCT- LS | D (40 s)/ LM(10 s) | D (40 s)/ HM(35 s) |
| | | FCT- MS | D (40 s)/ LM (10 s) | I (0 s)/ LM(10 s) |
| Maggie | MS= Quality LS= Immediacy | BL | HQ (bubbles)/ I (0 s) | LQ (ball)/ D (15 s) |
| | | FCT- LS | D (15 s)/ HQ (bubbles) | I (0 s)/ HQ (bubbles) |
| | | FCT- MS | D (15 s)/ LQ (ball) | D (15 s)/ HQ (bubbles) |
| Leo | MS= Quality LS= Immediacy | BL | HQ (break + iPad)/ I (0 s) | LQ (break)/ D (35 s) |
| | | FCT- LS | LQ (break)/ D (35 s) | LQ (break)/ I (0 s) |
| | | FCT- MS | LQ (break)/ D (35 s) | HQ (break + iPad)/ D (35 s) |

Note. MS= Most sensitive; LS= Least sensitive; HQ= high quality; LQ= low quality; HM= high magnitude; LM= low magnitude; I= immediate, D= delay

Table 4 *Social Validity Results*

| Question | Average ranking [range] |
|--|-------------------------|
| Based on the two videos: | |
| Did you observe a decrease in challenging behavior? | 4 [4, 4] |
| Did you observe an increase in communication? | 4 [4, 4] |
| Do you feel that the intervention was appropriate given your child's age and behavior? | 4 [4, 4] |
| Would you recommend this intervention to others? | 4 [4, 4] |

Note. 1= strongly agree, 2= somewhat agree, 3= mostly agree, 4= strongly agree

Appendix B

Figures

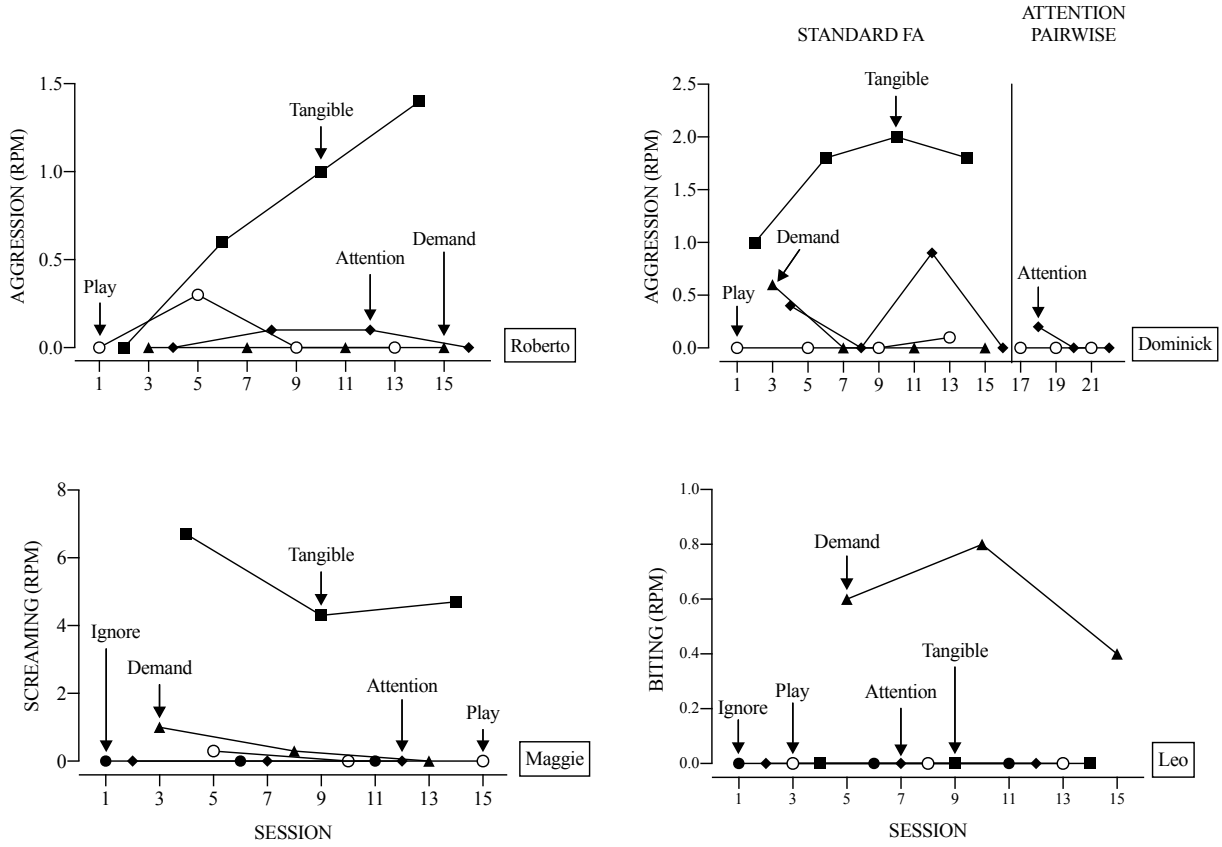


Figure 1 Results from the functional analyses for Roberto, Dominick, Maggie, and Leo

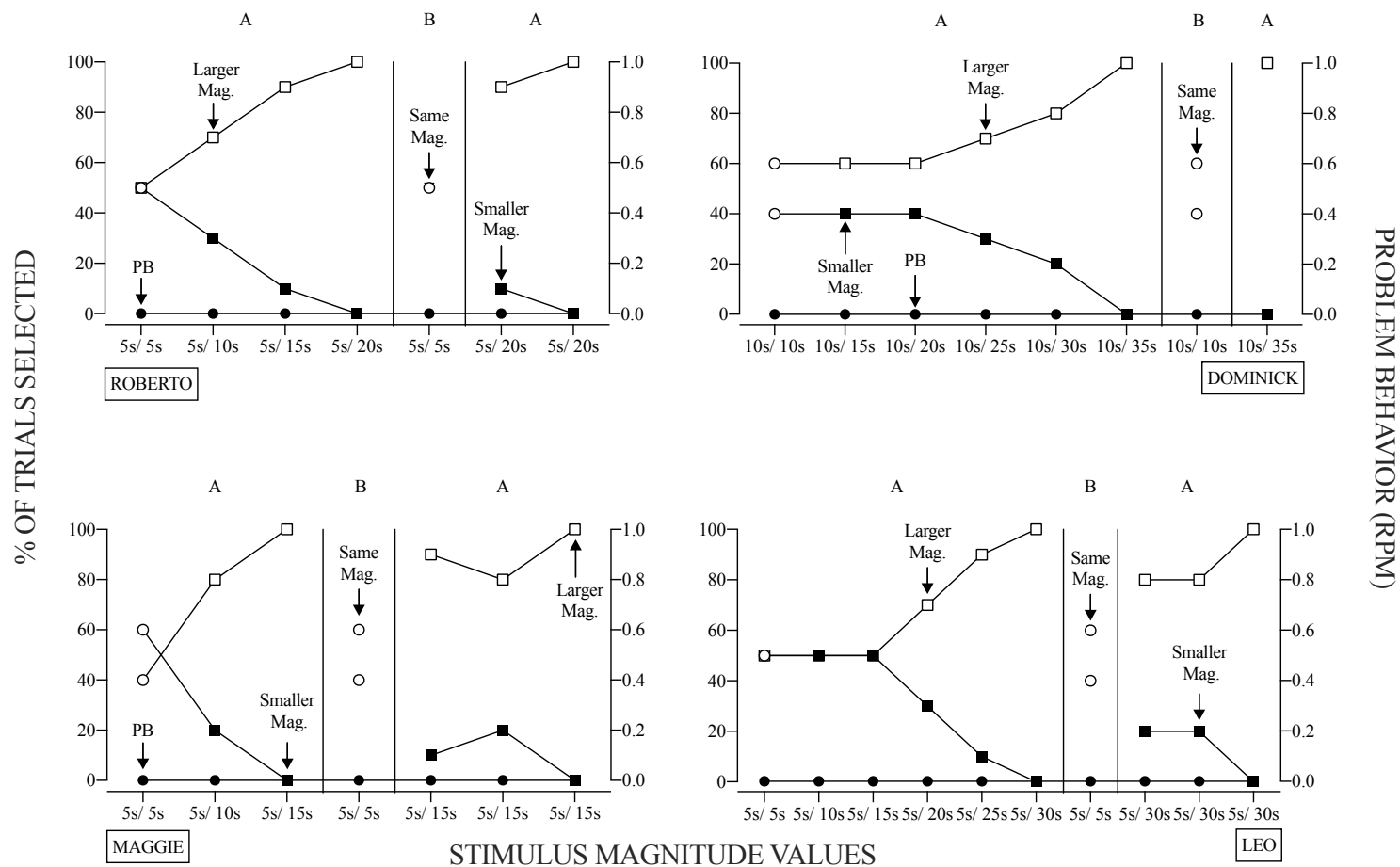


Figure 2 Results of the Stimulus Magnitude Preference Assessment for Roberto, Dominick, Maggie, and Leo

Note. The magnitude values (i.e., duration of access) concurrently available during the 10-trial session are shown on the X-axis. All reinforcers were delivered immediately.

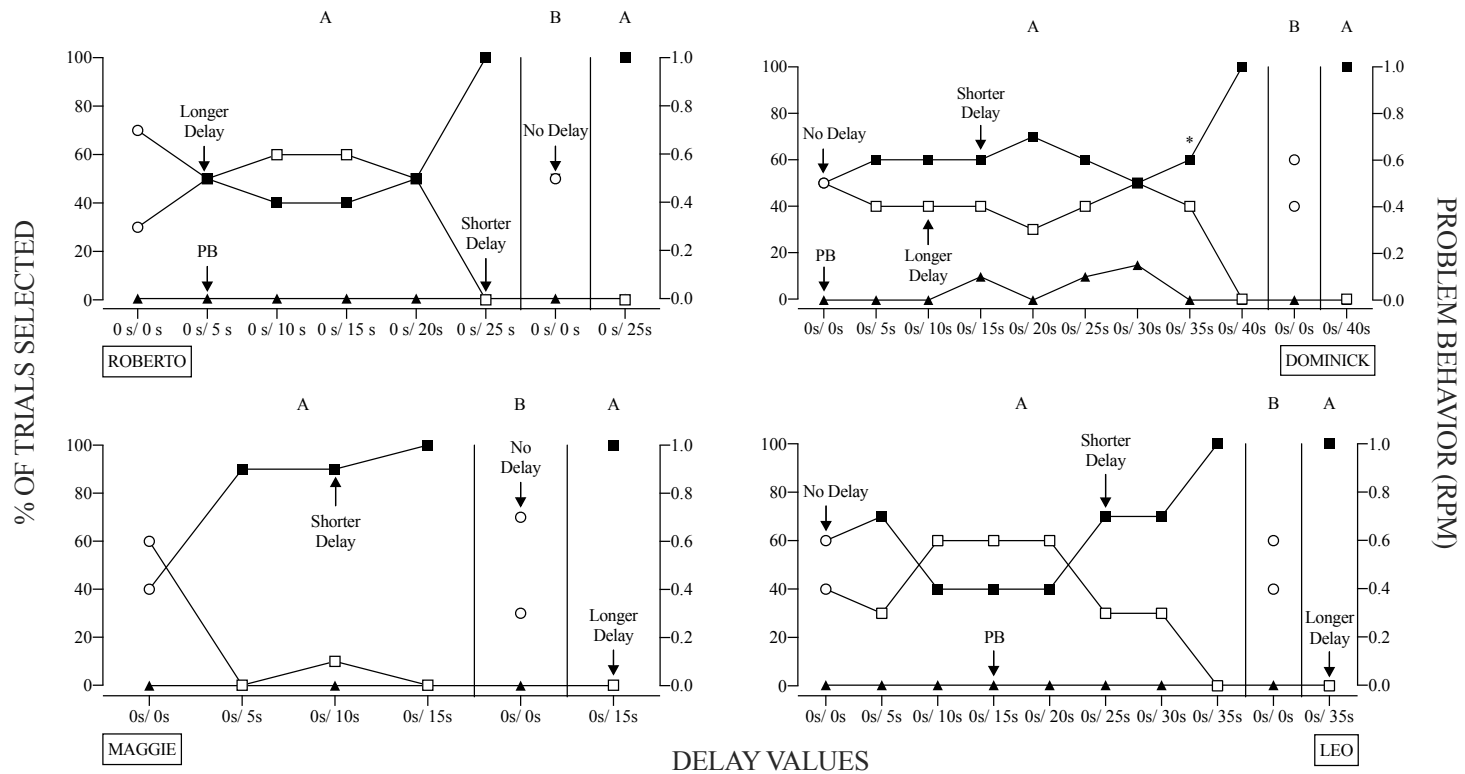


Figure 3 Results of the Delay Value Preference Assessment for Roberto, Dominick, Maggie, and Leo

Note. The magnitude value (20, 35, 15, and 30 s for Roberto, Dominick, Maggie, and Leo, respectively) remained constant whereas the magnitude of the delay (i.e., latency to access) concurrently available during the 10-trial session are shown on the X-axis. For Dominick, a rule was introduced (“Green card, no wait”) at the session with 0 s and 35 s delay values (i.e., the seventh session) denoted by an asterisk.

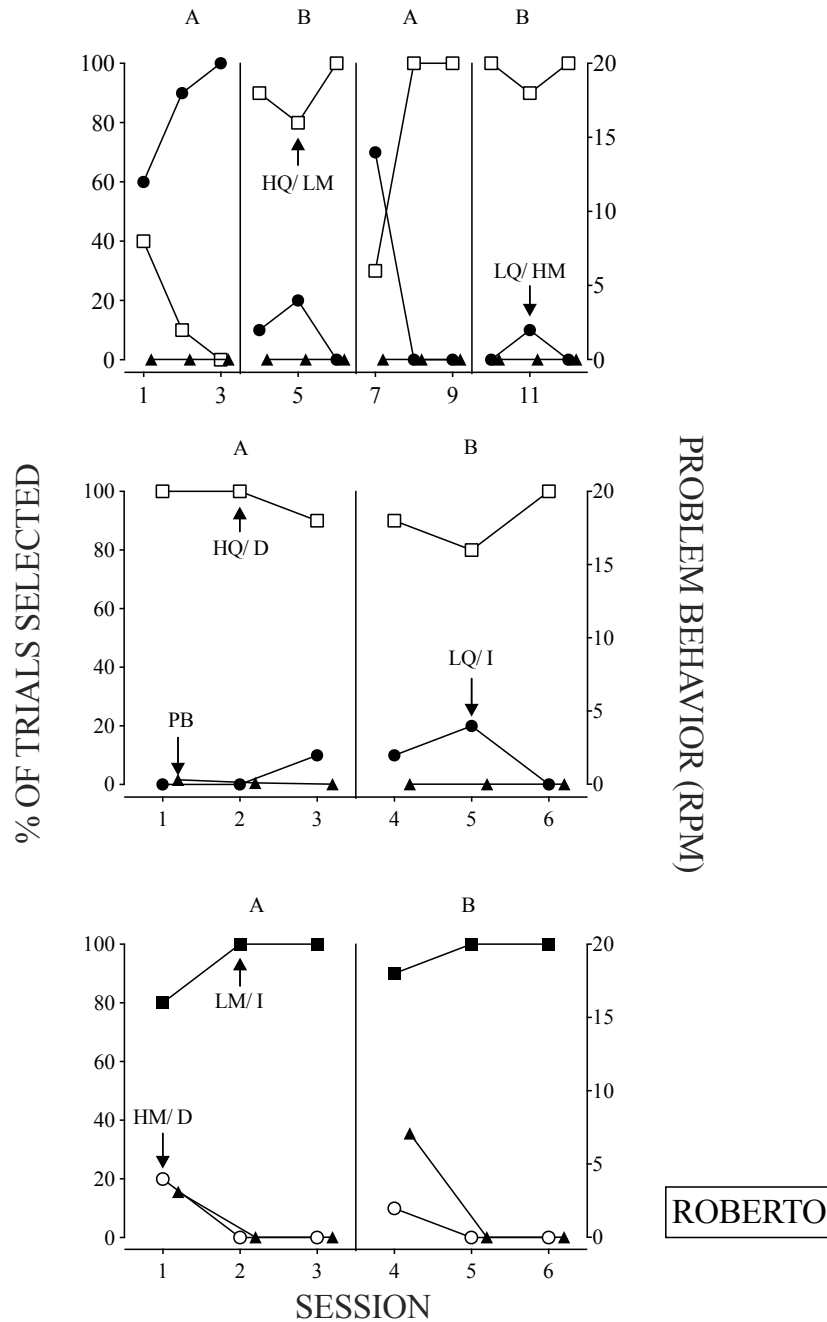


Figure 4 Results from the Relative Parameter Sensitivity Assessments for Roberto

Note. Quality versus magnitude are depicted in the top panel, quality versus immediacy in the middle panel, and magnitude versus immediacy are depicted in the bottom panel. The right Y-axis shows problem behavior (i.e., closed triangles).

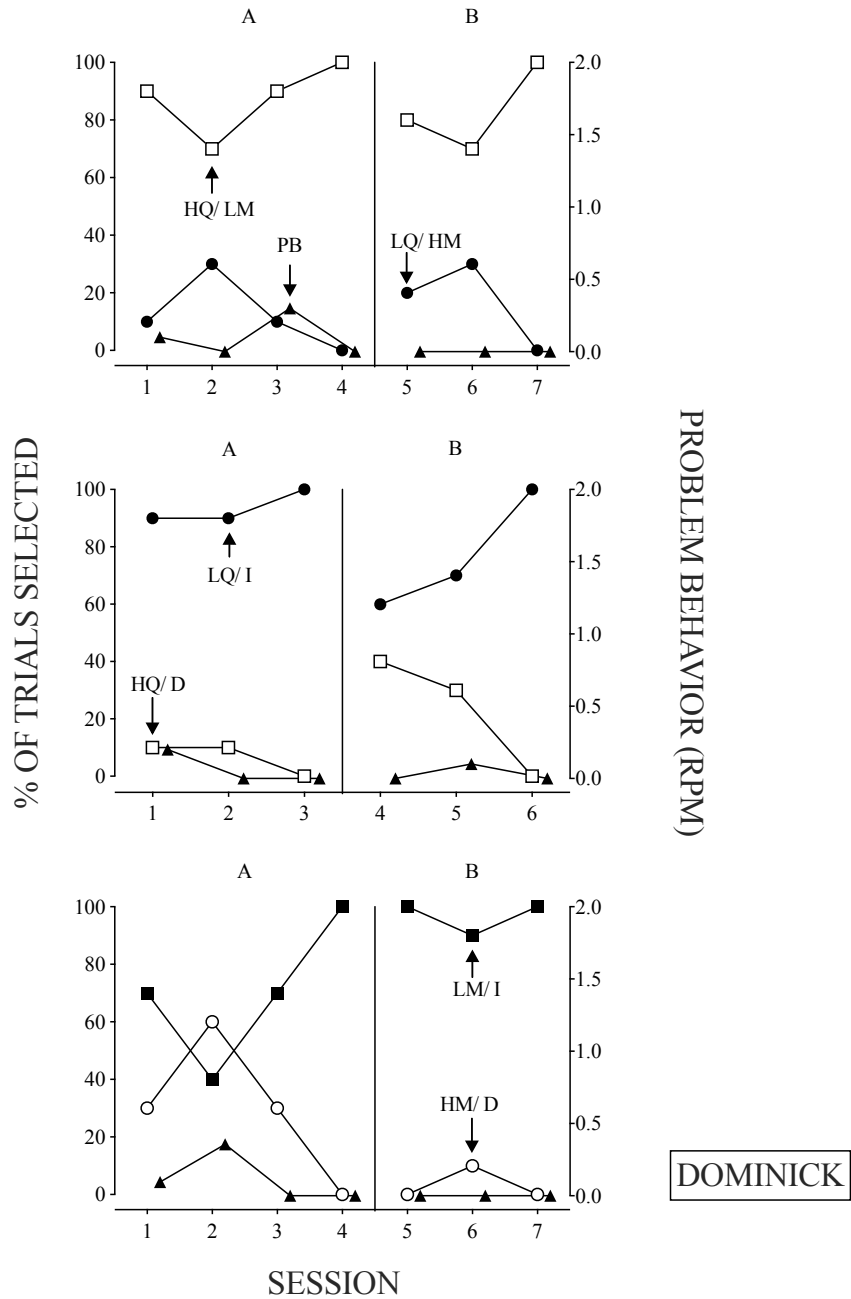


Figure 5 Results from the Relative Parameter Sensitivity Assessments for Dominick

Note. Quality versus magnitude are depicted in the top panel, quality versus immediacy in the middle panel, and magnitude versus immediacy are depicted in the bottom panel. The right Y-axis shows problem behavior (i.e., closed triangles).

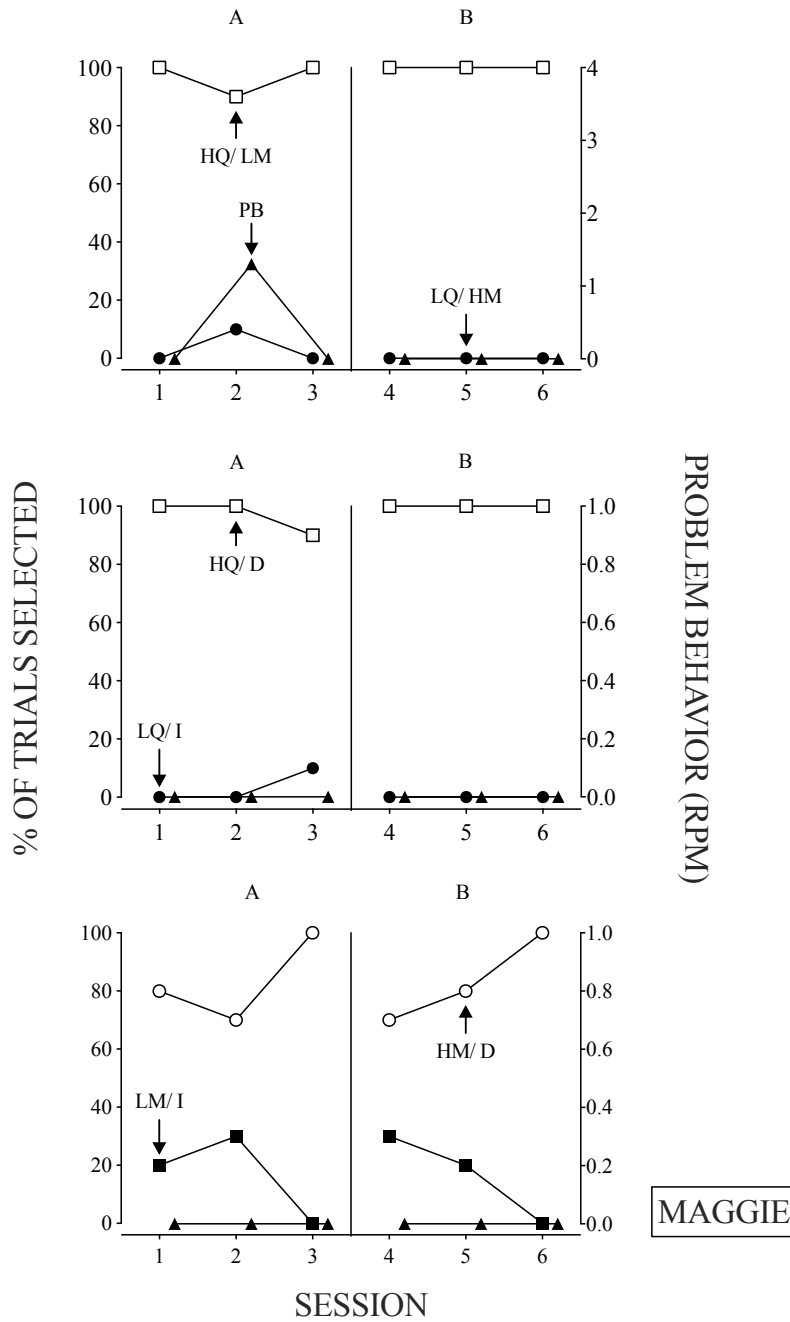


Figure 6 Results from the Relative Parameter Sensitivity Assessments for Maggie

Note. Quality versus magnitude are depicted in the top panel, quality versus immediacy in the middle panel, and magnitude versus immediacy are depicted in the bottom panel. The right Y-axis shows problem behavior (i.e., closed triangles).

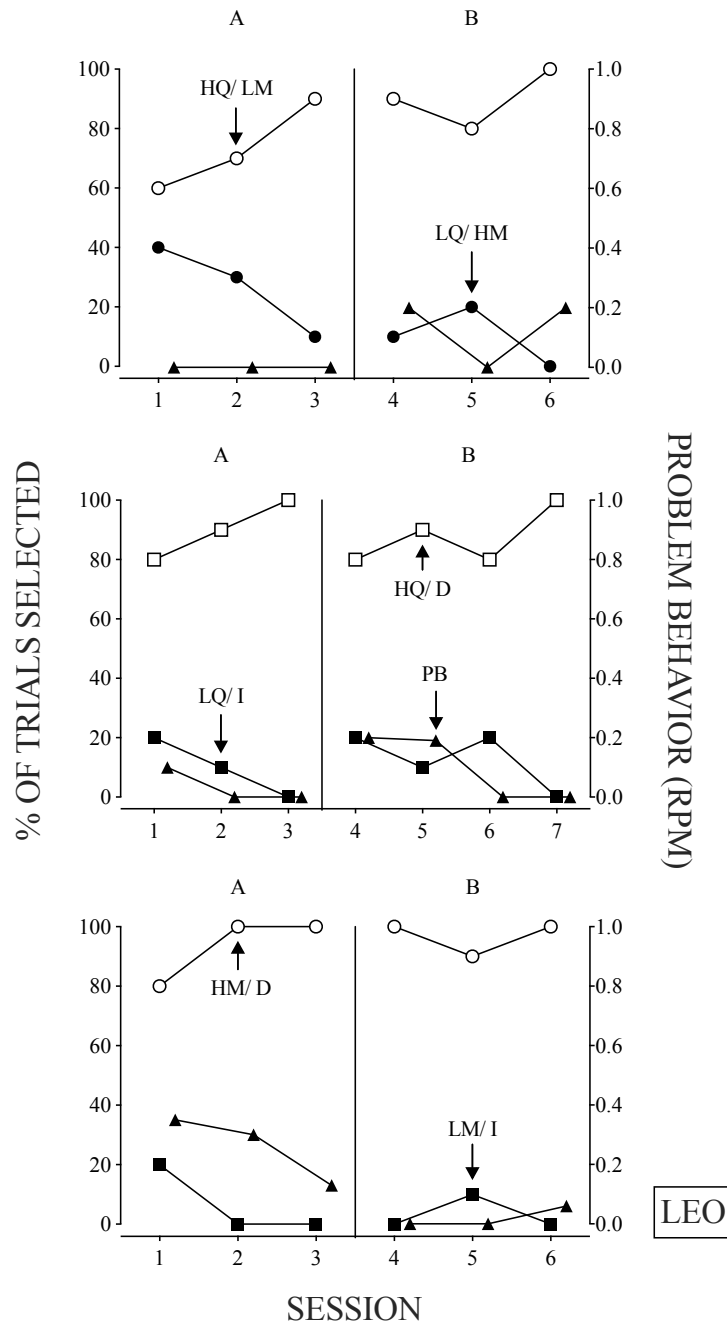


Figure 7 Results from the Relative Parameter Sensitivity Assessments for Leo

Note. Quality versus magnitude are depicted in the top panel, quality versus immediacy in the middle panel, and magnitude versus immediacy are depicted in the bottom panel. The right Y-axis shows problem behavior (i.e., closed triangles).

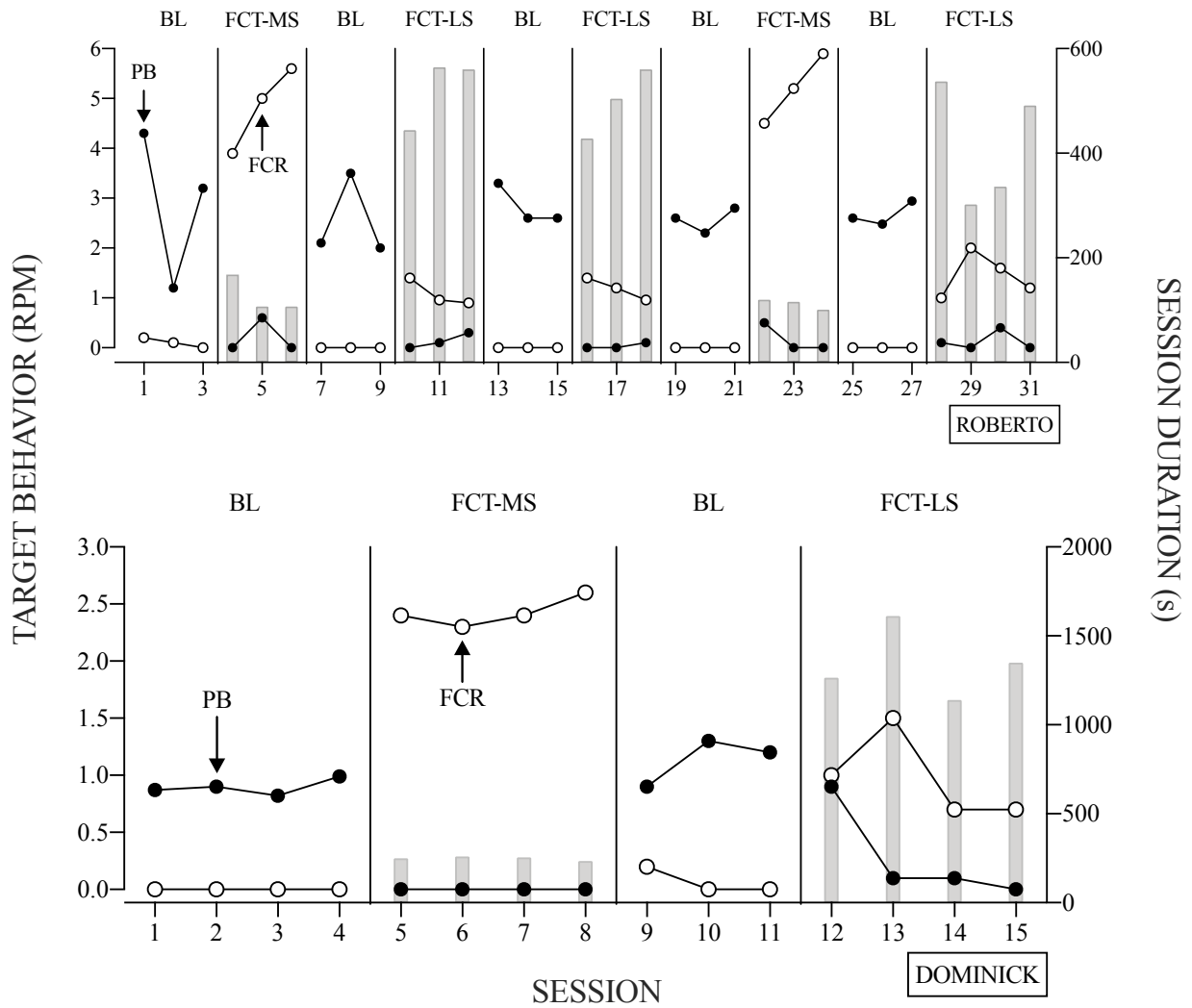


Figure 8 Results of the FCT evaluation for Roberto (top) and Dominick (bottom)

Note. The right Y-axis shows session duration (i.e., grey bars).

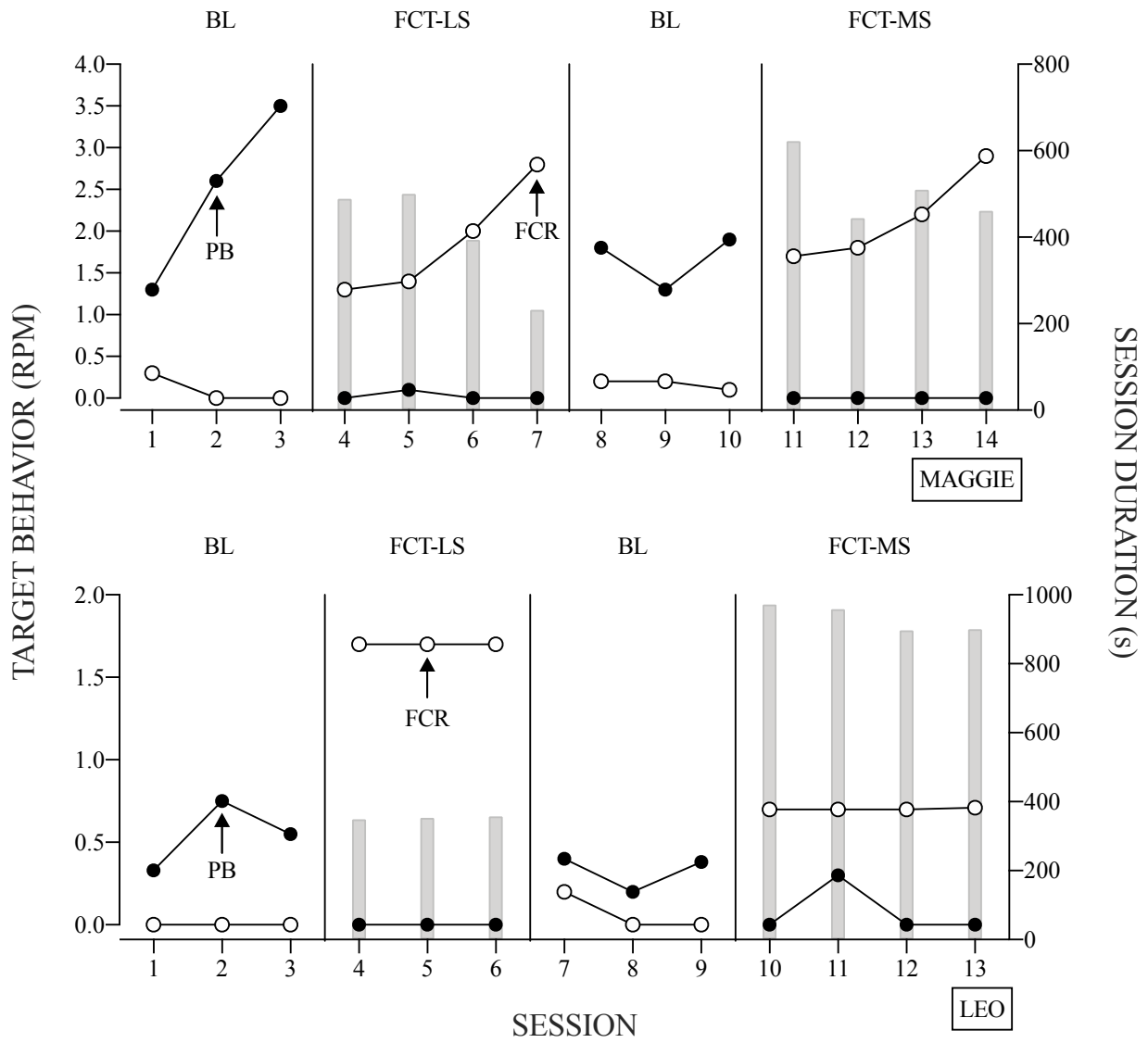


Figure 9 Results of the FCT evaluation for Maggie (top) and Leo (bottom)

Note. The right Y-axis shows session duration (i.e., grey bars).

Appendix C

Phone Screening Questionnaire

1. Does your child have an ASD diagnosis or other developmental disability?
2. What age is your son/ daughter?
3. Does he/she engage in problem behavior that impairs his/her daily life functioning (i.e., access to regular education or daily activities)?
4. What does the problem behavior look like?
5. How often does the problem behavior occur?
6. How intense is the problem behavior (i.e., causing minimal/ significant damage to self, others, the environment)?
7. When does this behavior occur? What usually happens after the behavior occurs?

Appendix D

Functional Analysis Screening Tool



Client: _____ Date: _____

Informant: _____ Interviewer: _____

To the Interviewer: The FAST identifies factors that may influence problem behaviors. Use it only for screening as part of a comprehensive functional analysis of the behavior. Administer the FAST to several individuals who interact with the client frequently. Then use the results to guide direct observation in several different situations to verify suspected behavioral functions and to identify other factors that may influence the problem behavior.

To the Informant: Complete the sections below. Then read each question carefully and answer it by circling "Yes" or "No." If you are uncertain about an answer, circle "N/A."

Informant-Client Relationship

1. Indicate your relationship to the person: Parent Instructor
 Therapist/Residential Staff _____ (Other)
2. How long have you known the person? Years Months
3. Do you interact with the person daily? Yes No
4. In what situations do you usually interact with the person?
 Meals Academic training
 Leisure Work or vocational training
 Self-care _____ (Other)

Problem Behavior Information

1. Problem behavior (check and describe):
 Aggression _____
 Self-Injury _____
 Stereotypy _____
 Property destruction _____
 Other _____
2. Frequency: Hourly Daily Weekly Less often
3. Severity: Mild: Disruptive but little risk to property or health
 Moderate: Property damage or minor injury
 Severe: Significant threat to health or safety
4. Situations in which the problem behavior is most likely to occur:
Days/Times _____
Settings/Activities _____
Persons present _____
5. Situations in which the problem behavior is least likely to occur:
Days/Times _____
Settings/Activities _____
Persons present _____
6. What is usually happening to the person right before the problem behavior occurs?

7. What usually happens to the person right after the problem behavior occurs?

8. Current treatments _____

- | | |
|--|------------|
| 1. Does the problem behavior occur when the person is not receiving attention or when caregivers are paying attention to someone else? | Yes No N/A |
| 2. Does the problem behavior occur when the person's requests for preferred items or activities are denied or when these are taken away? | Yes No N/A |
| 3. When the problem behavior occurs, do caregivers usually try to calm the person down or involve the person in preferred activities? | Yes No N/A |
| 4. Is the person usually well behaved when (s)he is getting lots of attention or when preferred activities are freely available? | Yes No N/A |
| 5. Does the person usually fuss or resist when (s)he is asked to perform a task or to participate in activities? | Yes No N/A |
| 6. Does the problem behavior occur when the person is asked to perform a task or to participate in activities? | Yes No N/A |
| 7. If the problem behavior occurs while tasks are being presented, is the person usually given a "break" from tasks? | Yes No N/A |
| 8. Is the person usually well behaved when (s)he is not required to do anything? | Yes No N/A |
| 9. Does the problem behavior occur even when no one is nearby or watching? | Yes No N/A |
| 10. Does the person engage in the problem behavior even when leisure activities are available? | Yes No N/A |
| 11. Does the problem behavior appear to be a form of "self-stimulation"? | Yes No N/A |
| 12. Is the problem behavior <u>less</u> likely to occur when sensory stimulating activities are presented? | Yes No N/A |
| 13. Is the problem behavior cyclical, occurring for several days and then stopping? | Yes No N/A |
| 14. Does the person have recurring painful conditions such as ear infections or allergies? If so, list: _____ | Yes No N/A |
| 15. Is the problem behavior <u>more</u> likely to occur when the person is ill? | Yes No N/A |
| 16. If the person is experiencing physical problems, and these are treated, does the problem behavior usually go away? | Yes No N/A |

Scoring Summary

Circle the number of each question that was answered "Yes" and enter the number of items that were circled in the "Total" column.

| Items Circled "Yes" | Total | Potential Source of Reinforcement |
|--------------------------|-------|---------------------------------------|
| 1 2 3 4 ____ | | Social (attention/preferred items) |
| 5 6 7 8 ____ | | Social (escape from tasks/activities) |
| 9 10 11 12 ____ | | Automatic (sensory stimulation) |
| 13 14 15 16 ____ | | Automatic (pain attenuation) |

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Appendix E

Caregiver Interview

1. What is your child's race/ ethnicity?

2. What kind of items does your child enjoy playing with (i.e., iPad, toys, etc.)?

3. What types of attention does your child appear to enjoy (i.e., hugs, high fives, spins, etc.)?

4. Do they have a current means of communication (i.e., vocal, picture exchange, AAC device, manual sign, etc.)?

5. Has your child been taught communication with other response modalities other than vocal responses? If so, what worked and did not work?

6. Is your child on any medications that might impact their alertness throughout the day? This could include medications with the side effect of drowsiness. If so, at what time are they administered?

7. What tasks can your child complete, but does not appear to enjoy (i.e., writing his/her name, stacking blocks, sorting towels)?

8. What dates and times are you available for research appointments?

Appendix F

Preference Assessment Data Sheet/ IOA/ TI

Paired Stimulus Preference Assessment Data Sheet/ Treatment integrity/ IOA

Observer: _____ Participant: _____ Date: _____

List item name and # of times selected next to each number (#)

Item 1: _____ (# _____) Item 4: _____ (# _____)
 Item 2: _____ (# _____) Item 5: _____ (# _____)
 Item 3: _____ (# _____)

| | | |
|--|---|---|
| Therapist has data sheet | Y | N |
| Therapist has writing utensil | Y | N |
| Therapist has picture cards | Y | N |
| Therapist is seated at table across from participant | Y | N |
| Therapist allows child to sample stimulus 1 | Y | N |
| Therapist allows child to sample stimulus 2 | Y | N |
| Therapist allows child to sample stimulus 3 | Y | N |
| Therapist allows child to sample stimulus 4 | Y | N |
| Therapist allows child to sample stimulus 5 | Y | N |

| Trial | Placement | Correct Placement | Vocal instruction (i.e. choose one) presented? | Therapist allows 5sec for participant to make a selection? | Chosen edible consumed? | Non-selected edible removed from array? | Trial represented once if no selection is made? | Trial discontinued if no selection is made on second presentation? | 5-10 seconds between trials? | Data recorded after trial? |
|-------|-----------|-------------------|--|--|-------------------------|---|---|--|------------------------------|----------------------------|
| 1 | 1 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 2 | 5 4 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 3 | 3 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 4 | 2 4 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 5 | 4 5 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 6 | 3 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 7 | 1 5 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 8 | 3 4 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 9 | 5 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 10 | 1 4 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 11 | 2 3 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 12 | 3 5 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 13 | 4 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 14 | 5 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 15 | 4 3 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 16 | 2 5 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 17 | 1 3 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 18 | 4 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 19 | 5 3 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 20 | 2 1 | Y N | Y N | Y N | Y N | Y N | Y N | Y N | Y N | Y N |

TI: _____ / 189 * 100= _____ %

IOA: _____ / 20 * 100= _____

Appendix G

Functional Analysis Treatment Integrity Data Sheet

TI collector: _____ Session: _____ Therapist: _____ Participant: _____

| Condition | Treatment integrity step | # tally correct/ # tally incorrect | # Correct/ Total |
|-----------------------|--|---------------------------------------|---------------------|
| No interaction | Participant in room with researcher | / | / |
| | No access to items | / | |
| | Therapist ignored all appropriate responses | / | |
| | No programmed consequences were delivered for the target behavior | / | |
| | Session terminated after 10 minutes | / | |
| Attention | Participant given moderately preferred item | / | / |
| | Participant told, "You can play with this if you want to." | / | |
| | Therapist told participant he/she will be busy. | / | |
| | No demands were placed. | / | |
| | Contingent on problem behavior, attention and brief physical contact was delivered | / | |
| | No programmed consequences delivered for appropriate behavior | / | |
| | After attention is delivered, therapist went back to "being busy" | / | |
| | Session terminated after 10 minutes. | / | |
| Control | Participant has access to variety of preferred items | / | / |
| | Therapist states, "You can do whatever you want play, or hangout." | / | |
| | Therapist delivered attention on a FT 30 s schedule or more often if initiated | / | |
| | If problem behavior occurs when attention should be delivered, attention is delayed 5-10 s | / | |
| | No programmed consequences for problem behavior | / | |
| | Session terminated after 10 min | / | |
| Tangible | Participant had access to most preferred item for 30 s | / | / |
| | After 30 s, therapist says, "my turn" and removes access to tangible | / | |
| | Tangible is moved to a location that is visible but out of reach from participant | / | |
| | Neutral attention is delivered on a FT 30 s schedule | / | |
| | Contingent on problem behavior, therapist gives item to participant for 30 s | / | |
| | After 30 s access, therapist says, "my turn" and access is removed | / | |
| | Session terminated after 10 min. | / | |
| Escape | 4-5 demands are presented in random order | / | / |
| | If participant complies w/o prompt, therapist presents next demand | / | |
| | If participant does not respond in 5 s, begin least-to-most prompting procedure | / | |
| | Contingent on problem behavior, remove all demands (turn away, no words) for 30 s | / | |
| | After 30 s elapses, therapist presents demands again | / | |
| | No programmed consequences delivered for appropriate behavior | / | |

_____ / _____ = _____ % TI

Appendix H

Stimulus Magnitude Preference Assessment Data Sheet/ IOA/ TI

Observer: _____ Participant: _____ Date: _____ Session #: _____

List magnitude stimulus value and # of times selected next to each number (#)

Magnitude value Stimulus 1: _____ () Magnitude value Stimulus 2: _____ ()

| | | |
|--|---|---|
| Therapist has data sheet | Y | N |
| Therapist has writing utensil | Y | N |
| Therapist has picture cards | Y | N |
| Therapist is seated at table across from participant | Y | N |
| Therapist prompts participant to sample stimulus 1 | Y | N |
| Delivers corresponding consequence | Y | N |
| Therapist prompts participant to sample stimulus 2 | Y | N |
| Delivers corresponding consequence | Y | N |

| Trial | Placement | Correct Placement | Vocal instruction (i.e. choose one) presented? | Therapist allows 5sec for participant to make a selection? | Correct magnitude delivered? | Non-selected stimulus removed from array? | Trial represented once if no selection is made? | Trial discontinued if no selection is made on second presentation? | 5-10 seconds between trials? | Data recorded after trial? |
|-------|-----------|-------------------|--|--|------------------------------|---|---|--|------------------------------|----------------------------|
| 1 | 1 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 2 | 2 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 3 | 1 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 4 | 2 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 5 | 1 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 6 | 2 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 7 | 1 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 8 | 2 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 9 | 1 2 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |
| 10 | 2 1 | Y N | Y N | Y N | Y N | Y N N/A | Y N N/A | Y N N/A | Y N | Y N |

TI: _____ / _____ * 100= _____ %

IOA: _____ / _____ * 100= _____ %

Appendix I

Relative Parameter Sensitivity Assessment Data Sheet/ IOA/ TI

Date: _____
 Participant pseudonym: _____
 Session #: _____
 Primary researcher: _____
 IOA/ TI data collector: _____

Exposure trials TI:
 Prompted participant to touch left switch (Y/ N)
 Delivered corresponding contingency: (Y/N)

Prompted participant to touch left switch (Y/ N)
 Delivered corresponding contingency: (Y/N)

Prompted participant to touch left switch (Y/ N)
 Delivered corresponding contingency: (Y/N)

| | Left (therapist side): Mark (X) if selected | Right (therapist side): Mark (X) if selected | Placed correct switch on left side: (Y/ N) | Placed correct switch on right side: (Y/ N) | Prompted: "Pick one": (Y/ N) | Delivered corresponding contingency? (Y/ N) |
|--|--|---|--|---|------------------------------------|--|
| Color: | | | | | | |
| Contingency: (HM/ I) & (LM/ D) (HQ/ D) & (LQ/ I) (HM/ LQ) & (LM/ HQ) | | | | | | |
| Trial 1 | | | | | | |
| Trial 2 | | | | | | |
| Trial 3 | | | | | | |
| Trial 4 | | | | | | |
| Trial 5 | | | | | | |
| Trial 6 | | | | | | |
| Trial 7 | | | | | | |
| Trial 8 | | | | | | |
| Trial 9 | | | | | | |
| Trial 10 | | | | | | |

Percentage of selection:

Contingency A (Left):

$$\frac{\text{_____}}{\text{(# times selected)}} / 10 \times 100 = \frac{\text{_____}}{\text{(percentage of selection)}}$$

Contingency B (Right):

$$\frac{\text{_____}}{\text{(# times selected)}} / 10 \times 100 = \frac{\text{_____}}{\text{(percentage of selection)}}$$

Treatment Integrity:

$$\frac{\text{_____}}{\text{(# steps completed correctly)}} / 46 \times 100 = \frac{\text{_____}}{\text{TI session score}}$$

Appendix J

DRA w/o EXT Data Sheet/ IOA/ TI

Date: _____ TI/ IOA collector: _____ Session: _____ Evaluation condition: _____

Contingency for FCR: _____ Contingency for PB: _____

| Trial | Response | Stimuli are in sight, but out of reach | Therapist delivers appropriate consequence contingent on PB? | Therapist delivers appropriate consequence contingent on FCR? | Therapist records response? | Therapist presents next FCT trial? |
|-------|----------|--|--|---|-----------------------------|------------------------------------|
| 1 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 2 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 3 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 4 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 5 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 6 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 7 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 8 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 9 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N |
| 10 | PB / FCR | Y/ N/ NA | Y/ N/ NA | Y/ N/ NA | Y/ N | Y/ N/ NA |

TI: _____ / 50 x 100 = _____

Appendix K

Social Validity Parent Questionnaire

Social Validity Questionnaire: Parent

1 = strongly disagree, 2 = somewhat agree, 3 = mostly agree, 4 = strongly agree

1. Based on the two videos you just saw:
 - a. Did you observe a decrease in challenging behavior from video A to video B?
1 2 3 4
 - b. Did you observe an increase in communication from video A to video B?
1 2 3 4
2. Do you feel that the intervention was appropriate given your child's age and behavior?
1 2 3 4
3. Would you recommend this intervention to others?
1 2 3 4
4. Do you have any additional comments?
