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# The Relative Contributions of Preference and Functionality in Noncontingent Reinforcement Schedules

Tamara L. Pawich

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Running head: PREFERENCE AND FUNCTIONALITY IN NCR

The Relative Contributions of Preference and Functionality in Noncontingent  
Reinforcement Schedules

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in

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## Abstract

Noncontingent reinforcement (NCR), the response-independent delivery of reinforcers, has been demonstrated to be an effective response suppression method for a variety of problem behaviors displayed by children. The purpose of the current study was to determine whether preference for specific reinforcers to another context led to greater response suppression through an experimental comparison of NCR with a functional reinforcer versus preferred stimuli. Two preschool-aged children with autism and tantrums maintained by tangible reinforcement participated. Preference values were evaluated through paired-choice and competing stimulus assessments. Three preferred stimuli were selected for NCR-Preferred experimental conditions, based on varied levels of preference (i.e., highest, lowest, moderate). The preference was confirmed to be nonfunctional through arbitrary reinforcement tests. Results indicated that NCR-Functional and NCR-Preferred had suppressive effects across participants, but the predetermined level of preference did not have an effect.

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Chapter 1: Introduction

Some children display disruptive and inappropriate behaviors such as tantrums, self-injury, aggression, property destruction, and self-stimulatory stereotypic behaviors. Because these behaviors are sometimes harmful and often impede the educational and social development of the child and others in the child's environment, it is imperative to develop the most effective strategies possible to reduce the frequency and severity of these behaviors. A variety of empirically validated response-reduction methods, based on operant theory, have emerged from the applied behavior analysis literature. These methods, collectively referred to as "contingency management," include extinction, punishment, differential reinforcement of other behavior (DRO), differential reinforcement of incompatible behavior (DRI), differential reinforcement of alternative behavior (DRA), and noncontingent reinforcement (NCR). Functional analysis and assessment techniques, which are designed to identify the contingencies maintaining problem behaviors exhibited by individual children, are presumed to have increased precision and effectiveness of contingency-management procedures. However, for some behavior-altering procedures, especially those designed to reduce problem behavior without punishment, empirical support demonstrating the superiority of functionally-derived contingencies is lacking. The functional analysis methodology has enhanced a general understanding of how some behavior-reduction contingencies operate but in other cases has raised theoretical inconsistencies and failed to demonstrate strong pragmatic utility. This is particularly true in the context of NCR procedures, which will be the focus of the current study.



*Functional Analysis and its Relevance to Behavior-Reduction Contingencies*

Skinner (1953, p. 35) first used the term *functional analysis* to emphasize that behavior is a function of reinforcement and associative contingencies, and he stressed the importance of collecting data to determine those contingencies. Historically, behavior-reduction contingency management techniques were based on nonquantitative anecdotal reports or descriptive analyses (Bijou, Peterson, & Ault, 1968) to identify the reinforcers presumed to be maintaining problem responses. Despite these shortcomings, such methods were usually sufficient to develop contingency management programs that effectively reduced behavior. For example, in one of the first successful applied demonstrations of extinction, Williams (1959) effectively suppressed an infant's excessive crying at bedtime by having the parents ignore it. This application was presumably effective because the parents were sufficiently accurate in their reports of problem to allow the investigator to accurately guess that attention was the maintaining the infant's crying. However, some researchers have reported that extinction and other similar procedures were not effective (e.g., Myers, 1975; Duker and Seys, 1983), probably due to inaccurate suppositions about the likely reinforcer or misidentification of the function of the response to be attention-maintained. It has been a common clinical misconception to assume that problem behavior is primarily attention-maintained (Ducharme & Van Houten, 1994; Iwata, Vollmer, Zarcone, & Rodgers, 1993). It was not until the 1980s that the experimental method, termed functional analysis, was developed as a formal systematic practice for determining or verifying the contingencies maintaining a particular problem behavior.

The basics of the functional analysis procedure were developed by Iwata and colleagues (1994) as an extension of well understood principles of experimental analysis of

behavior (Sidman, 1960) to the problem of identifying controlling variables in applied settings. In their early work, Iwata and colleagues needed to identify the function of self-injurious behavior (SIB) in individuals with developmental disabilities. Their procedure involved the use of “alternating treatments” or “multiple schedule” experimental design, so that only one potential reinforcement contingency operated at any given time. To test if the target response was maintained by social positive reinforcement in the form of attention, an *attention* condition was run in which a therapist sat next to the child and ignored all responses unless the child engaged in the target response, at which time the therapist delivered attention (i.e., a brief reprimand). During the *escape* condition, a difficult task was presented and contingent on the target response, the therapist discontinued the task and provided a 30-second break. In the *alone* condition, the child was isolated in a room, simulating a barren environment with no social or external sensory stimulation, to determine if the target response was maintained by unknown ecological or sensory reinforcers. In addition, if parents or clinicians presumed that the maintaining reinforcer of the target behavior was access to a preferred tangible item, then a *tangible* condition was added to the standard procedure, during which the item is available but inaccessible unless the child engaged in the target response. A *play* condition served as the control condition, during which no demands were placed on the child, attention was continuously given, and preferred objects were noncontingently available, thus eliminating motivating operations for engaging in the target response. After the functional analysis was completed, data were graphed and the condition in which the target behavior occurred at the highest rate was inferred to be the maintaining contingency.

The functional analysis methodology has been effectively applied to a wide range of troublesome aberrant responses, including aggression (e.g., Thompson, Fisher, Piazza, & Kuhn, 1998), bizarre speech (e.g., Lancaster, LeBlanc, Carr, Brenske, Peet, & Culver, 2004), elopement (e.g., Piazza, Hanley, Bowman, Ruyter, Lindauer, & Saiontz, 1997), inappropriate sexual behavior (e.g., Fyffe, Kahng, Fittro, & Russell, 2004), pseudoseizures (e.g., DeLeon, Uy, & Gutshall, 2005), vocal tics (e.g., Watson & Sterling, 1998), finger sucking (e.g., Stricker, Miltenberger, Anderson, Tulloch, & Deaver, 2002), pica (e.g., Piazza, Hanley, & Fisher, 1996), and stereotypic behavior (e.g., Kennedy, Meyer, Knowles, & Shukla, 2000). Functional analysis procedures have been proven to be reliable in identifying the idiosyncratic function of problem behaviors across participants because the precise experimental control eliminates (or at least reduces) multiple interpretations about controlling stimuli. For instance, in an expansive application conducted thus far, Iwata and colleagues (1994) identified the likely behavioral function of SIB in 152 participants. These results demonstrate the reliability of the functional analysis technique and emphasize the operant etiology of most idiosyncratic problem behaviors. Although it might not be effective in identifying functional reinforcers in all cases, especially for behavior maintained by infrequent periodic reinforcement, a functional analysis is likely to lead to treatments that are more effective than those based on guesses about functional contingencies (Iwata et al., 1993). This assumption has been empirically supported for extinction (e.g., Iwata, Pace, Cowdery, & Miltenberger, 1994), but not for other behavior-suppression contingencies.

#### *Extinction and Punishment*

The advent of the functional analysis methodology has led to more accurate and, therefore, more effective applications of extinction. Extinction involves withholding the

reinforcer, thereby thought to partially undo the reinforcement contingency that had been maintaining the target response (Sidman, 1960, p. 402). Hence, if an extinction contingency is planned, it is necessary to identify the reinforcers maintaining the target behavior. Early demonstrations of extinction are typified by the Williams (1959) study, in which an infant's crying at bedtime was suppressed through the systematic discontinuation of the attention contingency. Williams (1959) was also typical of early applied studies in its failure to mention how it was determined that attention was the maintaining reinforcer—although in that case the likely reinforcer was easy to guess. Lack of information on function may account for the frequent failure rate of extinction in the early studies (Ducharme & Van Houten, 1994). The lack of procedural details is also demonstrated in the case of Duker and Seys (1983), in which the authors attempted to use extinction to decrease SIB and achieved minimal results in five out of seven participants. It is unclear why extinction was unsuccessful because the authors did not provide specific methodological information regarding how functional assessment and extinction conditions were conducted. Presumably, either the presumed reinforcer was the wrong one, or the behavior was maintained by other contingencies. In contrast, later studies, such as Iwata, Pace, Cowdery, and Miltenberger (1994), demonstrated that extinction was only effective when the functionally-derived contingency was incorporated into the intervention.

Despite the fact that there are empirical findings that support the conclusion that functionally-based extinction contingencies are likely to accurately identify stimuli maintaining problem behavior, there is less evidence for this when the behavior is maintained by more complex contingencies. Specifically, several studies using interpolated reinforcement have shown that extinction can operate under certain conditions without

withholding the reinforcer responsible for behavioral maintenance (e.g., Foxx & McMorrow, 1983; Glavin & Moyer, 1975; Schmid, 1986). For example, Neisworth, Hunt, Gallop, and Madle (1985) first reinforced stereotypic responses with edible reinforcers and then withheld those reinforcers during an extinction intervention. Although these studies show that extinction using nonfunctional reinforcers (i.e., reinforcers that are not accountable for behavioral maintenance) can produce response reductions, these reductions were small and temporary. In some cases, there was no effect at all (e.g., Sidener, Carr, & Firth, 2005). It is difficult to make conclusions based on the mixed results of these few studies, at least in part, because it was difficult to ascertain the original function of the target response and, thus, the interaction between the functional and interpolated reinforcers. Therefore, while it can be concluded that function-based extinction is not necessary for achieving response reductions, they are superior. However, a similar case cannot be made for other behavior-reduction contingencies.

Although extinction procedures have been shown to be effective when the functional reinforcer responsible for behavioral maintenance is properly identified and manipulated (e.g., Iwata, Pace, Cowdery, and Miltenberger, 1994), there are several disadvantages associated with this procedure. Extinction procedures are known for producing initial bursts in target responding (i.e., an extinction burst), emotional behavior, and extinction-produced aggression (Goh & Iwata, 1994). These problems point to the importance of developing effective alternative methods, especially when treating harmful and dangerous behaviors (Cooper, Heron, & Heward, 2007). Prior to the development of the functional analysis technology, these techniques consisted of superimposing additional contingencies, such as punishment and differential reinforcement schedules, in an effort to override the reinforcers

maintaining a problem response (Mace, 1994). Historically, punishment was used effectively to control severe behavior, especially when extinction and reinforcement-based methods failed to decrease response rate (e.g., Barrett, Matson, Shapiro, & Ollendick, 1981; Corte, Wolf, & Locke, 1971; Foxx & Azrin, 1973; Rolider & Van Houten, 1984). Nevertheless, because of the difficulty of incorporating important factors when applying punishment (Lerman, & Vorndran, 2002), as well as growing legal and ethical concerns, there has been a shift in focus to developing alternatives to both punishment and extinction (Pelios, Morren, Tesch, & Axelrod, 1999).

### *Differential Reinforcement*

Two of the earliest alternatives to extinction and punishment were differential reinforcement schedules in the form of differential reinforcement of other behavior (DRO) and differential reinforcement of incompatible behavior (DRI). DRO is a procedure during which a reinforcer is delivered at the end of an interval during which the target response has not occurred (Wallace & Robles, 2003). DRI involves the delivery of a reinforcer contingent on the occurrence of a behavior that cannot occur at the same time as the problem response (Vollmer & Iwata, 1992). Before functional analysis methodology had become common in applied research, these procedures were typically implemented using reinforcers that were presumed to be effective (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). For instance, in a classic study conducted by Repp and Deitz (1974), two children with developmental disabilities were given reinforcers (i.e., M & M candy and puzzle pieces) after periods when no aggressive responses occurred. Both DRO and DRI have been reported to have had variable behavior-reduction effects (Vollmer et al., 1993; e.g., Spira, Koven & Edelstein, 2004), and thus have often been combined with extinction and sometimes punishment (e.g.

Allen & Stokes, 1987; Beaton, Peeler, & Harvey, 2006; Bostow & Bailey, 1969; Lockwood & Williams, 1994; Peterson & Peterson, 1968; Thomas, Becker, & Armstrong, 1968). For example, results of the Repp and Deitz (1974) study indicated that DRO was effective when combined with time-out, verbal instructions, response cost, or mild punishment; however, the authors did not include a condition to test the effectiveness of DRO alone. In at least one study that did compare DRO with and without extinction, it was demonstrated that DRO did not work at all unless combined with extinction and that its effects may have been entirely due to extinction (Mazaleski et al., 1993). Similarly, another study found DRI contingencies to be ineffective, even when combined with extinction and DRO, in reducing chronic hand mouthing unless combined with punishment (Lockwood & Williams, 1994). However, other studies have shown that DRO contingencies can effectively reduce stereotypic behavior in the absence of extinction contingencies by using other preferred stimuli (e.g., money) that do not maintain the response (Ringdahl et al., 2002; Taylor, Hoch, & Weissman, 2005; Woods & Himle, 2004). Similarly, Friman and Altman (1990) demonstrated that DRI could be effective without extinction, specifically in reducing the frequency of hand mouthing and disruptive responses by using edible reinforcers. These studies indicate that the necessary conditions for response suppression in DRO and DRI contingencies remains unclear.

One possible explanation for the limited effectiveness of certain DRO and DRI procedures is the failure to use functional reinforcers (Vollmer et al., 1993), presumably because the researchers or clinicians simply guessed incorrectly about what might be reinforcing in the DRO or DRI context. Since the development of functional analysis, it has been recommended practice to identify and integrate functional reinforcers into DRO and DRI treatment conditions (e.g., Bonem, 2005), with the presumption that nonfunctional

reinforcers may only be effective in reducing response rate when the reinforcers are more potent than the functional reinforcer (Vollmer & Iwata, 1992). In addition, it is unknown how often functional reinforcers are actually being used instead of preferred reinforcers in applied settings. Similarly, although DRI procedures are rarely implemented since the development of Differential Reinforcement of Alternative Behavior (DRA) procedures (Vollmer & Iwata, 1992), when used they more typically continue to incorporate nonfunctional reinforcers, especially in non-research settings (e.g., Spira et al., 2004).

DRA is a variant of DRO procedures, in which the behavior is reinforced for engaging in appropriate replacement responses, rather than simply providing reinforcement after periods in which the child does not engage in the target response. Functionality and preference of reinforcers have also been more explicitly examined within the context of DRA procedures, specifically focusing on incorporating the functional reinforcer and, in some cases, demonstrating the utility of functional analysis in determining the most effective contingency intervention (e.g., Carr & Durand, 1985). In an early demonstration of the effectiveness of DRA, Hall, Lund, and Jackson (1968) delivered attention, the functional reinforcer identified via observational analysis, contingent on appropriate “study behavior.” In other cases, DRA probably failed to be effective when the functional reinforcer was not identified correctly. The development of functional analysis methods has allowed researchers to ensure that they are incorporating reinforcers that are truly functional. For instance, many studies examining functional communication training (FCT), a DRA technique in which children receive a reinforcer contingent on engaging in a shaped communicative response, have found that problem responses are suppressed more completely when the communication response produces the functional reinforcer responsible for behavioral maintenance rather



than other reinforcers included in the functional analysis (e.g., Carr & Durand, 1985). In this study, disruptive responses of children were classified according to function as being maintained by either escape or attention. For different subjects, either escape or attention was deemed the relevant reinforcer and the other was irrelevant. Reduction in disruptive behavior occurred only when the relevant reinforcer was delivered contingent on the communicative response. Although such studies provide impressive evidence regarding the effectiveness of DRA contingencies, presumably because they integrate functional reinforcers, they do not provide evidence that the functional reinforcer is superior to all stimuli that may be incorporated into a DRA-type contingency. Notable examples of effective DRA schedules using nonfunctional reinforcers include a study conducted by Fisher, Kuhn, and Thompson (1998) that compared FCT to Alternative Communication Training, in which preferred stimuli were delivered contingent on an alternative communication response. They concluded that both the preferred stimulus and the functional reinforcer for destructive behavior were equally effective in reducing behavior. Similarly, Adelinis, Piazza, and Goh (2001) found that preferred edible reinforcers, demonstrated to be nonfunctional, when contingent on a communication response effectively reduced aggressive behavior, even when aggression continued to produce escape or attention, the identified functional reinforcers. These findings seemingly contradict Carr and Durand (1985), which demonstrated that only the functional reinforcer was effective within DRA procedures.

### Noncontingent Reinforcement

The focus of the current study is noncontingent reinforcement (NCR). NCR, a procedure in which a functional reinforcer is delivered, response-independently to a predetermined time schedule (Carr, Bailey, Ecott, Lucker, & Weil, 1998). In what might be

the earliest applied demonstration of NCR, Ayllon and Michael (1959) conducted an NCR procedure with five patients in a psychiatric ward by inundating them with magazines, the presumed reinforcer for stealing, as determined by staff reports. The authors speculated that noncontingent access to these desired reinforcers made it unnecessary for participants to engage in the target behavior to receive the reinforcer. Similarly, in the classic study conducted by Ayllon (1963), a schizophrenic patient was flooded with towels ranging from seven to 60 towels per day, the hypothesized reinforcer for hoarding. In early applied literature, NCR was more typically used as an experimental control procedure (e.g., Baer & Sherman, 1964; Lattal, 1969; O'Neill & Morris, 1979; Redd, 1969a; Sheppard, 1969) to demonstrate the efficacy of using contingent reinforcement in shaping and increasing the acquisition of appropriate social behaviors. For example, Hart, Reynolds, Baer, Brawley, and Harris (1968) compared noncontingent teacher attention to attention provided on a fixed-ratio (FR) 1 schedule contingent on cooperative play in a five year-old girl. Results demonstrated that cooperative play behaviors occurred at higher rates during conditions in which the participant received contingent social attention than during days when the child received noncontingent attention. In addition, Redd (1969b) delivered candy contingent on cooperative social behaviors and compared this contingency to an NCR control condition. During NCR, candy delivery was on a fixed-time schedule that was yoked to the reinforcer delivery rate in the contingent condition. Despite the fact that reinforcement rates were similar in both conditions, participants responded at consistently higher rates when reinforced contingent on engaging in target behavior. These examples demonstrate that NCR was considered an inferior procedure to contingent reinforcement schedules for increasing acquisition of skills.

Although some early cases demonstrated the effectiveness of applying NCR to decrease response rates (e.g., Boe, 1977; Thelen, 1979), these studies were conducted when NCR was still primarily considered a control procedure and functional reinforcers were only hypothesized. It was not until the wider use of the functional analysis technology that NCR was adopted more broadly. It is not surprising that like other reinforcement-based behavior-reduction procedures such as DRO and DRI, some earlier studies demonstrated that NCR had only limited effects in decreasing problem behaviors (e.g., Foxx & Azrin, 1973; Horner, 1980). These findings are probably due to the lack of experimental methodology to ascertain the behavioral function of these behaviors or the misidentification of potent, competing stimuli because stimulus preference assessments had not yet been developed.

Since the use of functional analysis technology, numerous examples of successful use of NCR for reducing aberrant behavior have been published (e.g., Austin & Soeda, 2008; Coleman & Holmes, 1998; Lalli, Casey, & Kates, 1997; Roscoe, Iwata, & Goh, 1998). In addition, Severtson, Carr, and Lepper (2008) conducted a recent quantitative meta-analysis, which indicated that NCR with functional reinforcers (i.e., those responsible for behavioral maintenance) is a well-established treatment for aberrant behaviors displayed by persons with developmental disabilities. The procedure is considered effective, in part, because the child no longer needs to engage in the target behavior to receive the functional reinforcer and in part because of extinction, which is usually an inherent component of the procedure (Vollmer & Wright, 2003). In addition, NCR is effective because alternative behaviors to the aberrant target response are strengthened (Hagopian, Crockett, Van Stone, DeLeon, & Bowman, 2000). Although the procedure does not teach appropriate replacement responses, NCR has several advantages over other reinforcement-based procedures that decrease

response rate. Often response rate reduction is more rapid in NCR than with other methods, such as sensory extinction (e.g., Roscoe et al., 1998) and DRO (e.g., Vollmer et al., 1993). Furthermore, unlike other response-suppression techniques such as differential reinforcement schedules and punishment, the implementation of NCR does not require the therapist to monitor each response (Vollmer et al., 1993). Because of its simplicity, it is relatively easy to train and gain the cooperation of others such as parents, caregivers, and teachers to implement NCR compared to other response-reduction methods. Moreover, there are fewer side effects associated with NCR compared to extinction by itself, which can be characterized with response bursts, emotional responding, and aggression (Vollmer & Wright, 2003). In short, NCR is an important focus of applied research because it can result in rapid and more complete, although only temporary, response suppression than other reinforcement-based procedures. However, there is a paucity of research identifying the necessary and sufficient conditions for achieving an effect, especially with regard to the relative contributions of extinction, satiation, functionality, and preference.

The usual NCR procedure involves first conducting a functional analysis to determine the reinforcer maintaining a particular problem behavior. For example, Hagopian, Fisher, and Legacy (1994) conducted a functional analysis of the destructive behavior of a set of identical quadruplets, determining that attention was the functional reinforcer maintaining the response for all four children. The NCR procedure involved providing attention in the form of adult play interactions according to schedules ranging from continuous NCR and eventually thinning to leaner NCR schedules. A variation of NCR, noncontingent escape (NCE), has also been shown to effectively decelerate behaviors maintained by escape contingencies (Coleman & Holmes, 1998). NCE involves removing the aversive stimulus on

a predetermined schedule, independent of responding. Coleman and Holmes (1998) demonstrated response reduction utilizing NCE to treat disruptive behavior maintained by escape during speech therapy activities by delivering breaks on a fixed time-1 minute schedule and then increasing the time between breaks by 30 seconds after the subjects did not engage in the target response for three consecutive sessions.

*Behavioral Processes Responsible for Response Suppression in NCR*

In typical NCR procedures, it is most often assumed by applied researchers that response suppression occurs due to an abolishing operation—a variable that momentarily reduces the value of the reinforcer (Michael, 2000)—typically satiation. Satiation is proposed to be responsible for a decrease in responding because the reinforcer is available frequently and delivered independent of the client's behavior, eliminating the motivation to engage in the target response. However, since most NCR procedures incorporate an extinction component, it is hypothesized that decreases in the target behavior could alternatively be attributed to this factor (Vollmer & Wright, 2003).

The research literature provides support for both satiation and extinction as processes responsible for behavior reduction. It has been demonstrated that denser NCR schedules are more effective in suppressing response rate than leaner NCR schedules (Hagopian et al., 1994). The fact that response rates temporarily increase after NCR conditions end as the participant becomes deprived of reinforcement (Kahng, Iwata, Thompson, & Hanley, 2000) also provides support for the contribution of satiation. However, Marcus and Vollmer (1996) did not find support for satiation as the operative mechanism. The authors examined the combined use of NCR and DRA on problem behavior and functionally equivalent verbal responses. Results indicated that functionally equivalent responses did not decrease as the

target behavior decreased. If the participants were truly satiated, they would not have continued to engage in verbal responses to obtain additional reinforcement.

Satiation has been therefore ruled out as the sole operative mechanism in NCR, implying the contribution of extinction in the effectiveness of the procedure. However, extinction has also been ruled out as a necessary condition for behavior reduction as demonstrated by Lalli and colleagues (1997), who showed that noncontinuously-available NCR without extinction was effective in reducing the target response. By comparing the effects of NCR procedures with and without an extinction component, it was determined that the NCR without extinction procedure was sufficient to suppress response rate. Nonetheless, NCR with the extinction condition was superior in suppressing behavior, which demonstrates the added contribution of extinction to the procedure.

An alternative explanation that is often ignored by applied researchers is the matching law, a widely accepted explanation for the response suppression effects observed in NCR in basic research. First proposed by Herrnstein (1961) to describe the proportional relationship between the distributions of responding between two concurrent schedules of reinforcement, the matching law states, "Given two concurrently available response alternatives, the relative rate of responding equals the relative rate of reinforcement" (Bourret & Vollmer, 2003). The matching law predicts that NCR is effective in reducing behavior problems because the response-independent delivery results in adventitious reinforcement of alternative responses (Ecott & Critchfield, 2004). In his classic article entitled "Superstition in the Pigeon," Skinner (1948) first cited the effects of adventitious or "superstitious" reinforcement after observing that delivering food response-independently increased the probability of stereotyped responses, such as head bobbing, circling, and neck stretching, in six of his eight

pigeons. Only a few applied studies have documented the effects of adventitious reinforcement in terms of strengthening target behavior (e.g., Marcus & Vollmer, 1996), yet most studies fail to measure other alternative behaviors (Ecott & Critchfield, 2004). A notable exception is Hagopian, Crockett, Van Stone, DeLeon, and Bowman (2000), in which stimulus engagement was measured during NCR conditions to determine if engagement, the alternative behavior, increased due to adventitious reinforcement. NCR with and without extinction conditions were conducted to demonstrate that extinction was not necessary or responsible for response suppression. Findings indicated that all subjects interacted with the reinforcers at consistently high rates during NCR regardless of the density of schedule, indicating that satiation could not explain treatment effects. Target responses decreased to levels near zero even when extinction contingencies were not in place. These results are similar to those obtained in many basic studies with concurrent schedules of NCR and response-dependent reinforcer delivery, in which decreases in target responding on the response-dependent schedule are observed (e.g., Rachlin & Baum, 1972).

In a laboratory demonstration, Ecott and Critchfield (2004) tested the matching law in NCR schedules with six undergraduate students by arranging concurrent schedules in a computer program. Two boxes were continuously available on the screen, and participants were instructed to click on either box as often as they wanted in order to receive points after being informed that each box had different “pay-offs.” During baseline, points were awarded contingent on responding on various variable-interval schedules for the target behavior and noncontingently for the alternative option. During NCR conditions, the alternative behavior option was yoked to the reinforcement schedule used during baseline, while the target behavior had a randomly determined portion of the session in which points were delivered

independent of responding. Results indicated that as the percentage of NCR increased, target behavior decreased while alternative behavior increased, providing support for the general matching law.

*Arbitrary versus Functional Reinforcers in NCR*

Research has focused on the utility of using stimuli other than the functional reinforcer within NCR schedules in order to suppress problem behaviors when the functional reinforcer is not available (e.g., Shore, Iwata, DeLeon, Kahng, & Smith, 1997), cannot be manipulated (e.g., Fisher, O'Connor, Kurtz, DeLeon & Gotjen, 2000), cannot be identified (e.g., Vollmer et al., 1994), or may harm the subject (e.g., Goh, Iwata, & Kahng, 1999). These applications of NCR have incorporated stimuli that have not been demonstrated to maintain the target response during the functional analysis (e.g., Hanley, Piazza, & Fisher, 1997). Such NCR schedules have been shown to be effective in suppressing the target response. Some authors have referred to these stimuli as arbitrary, in contrast to the functional reinforcers usually incorporated in NCR procedures (e.g., Fischer, Iwata, & Mazaleski, 1997). For example, Hanley and colleagues (1997) found that continuous schedules of either noncontingent attention or tangible reinforcers were effective in reducing attention-maintained problem behaviors. In fact, for one of the participants, using NCR with a highly preferred tangible stimulus (HP) suppressed behavior better than noncontingent attention, the identified functional reinforcer. However, extinction was incorporated into both NCR procedures; therefore, it is unknown whether response suppression was due to the continuous delivery of an arbitrary reinforcer or extinction.

The importance of satiation as a mechanism operating in typical NCR schedules calls into question the operating behavioral principle in arbitrary NCR. The satiation and



extinction hypotheses have only been applied to NCR procedures using functional reinforcers. Satiation cannot be a mechanism contributing to the effects of arbitrary NCR because it is conceptually impossible to satiate an individual on a reinforcer that does not maintain the target response. In addition, research has indicated that extinction is not thought to be responsible for response reduction in arbitrary NCR procedures. For instance, Fischer et al. (1997) did not include extinction in their procedure and achieved significant response suppression across two participants. Therefore, if satiation cannot explain the effects of arbitrary NCR and extinction has been proved an unnecessary condition, it begs the question of what is the mechanism responsible for this effect. Although isolating the operating principles in arbitrary NCR is not the focus of the current investigation, it is important to understand why this procedure suppresses behavior.

Most studies of arbitrary NCR utilize a stimulus that is nonfunctional, but preferred, by first conducting some form of preference assessment as a means of predicting the stimuli that will compete with the functional reinforcer. For example, Fisher and colleagues (2000) determined an index of preference by conducting a 15-item preference assessment in which levels of interaction and frequency of disruptive behavior were observed while each stimulus was presented singly for 30 seconds. The items determined as highest preferred (HP) and lowest preferred (LP) through the preference assessment were then included in NCR conditions without extinction to compare the relative effects of preference to treat attention-maintained destructive behavior. Results indicated that NCR was only effective when the subject received noncontingent access to the HP. However, this study did not examine whether the HP used (i.e., music) was functional or arbitrary. Therefore, while it is clear that

HP can be effective within an NCR schedule, it is not clear whether the effect is due to preference, because functionality has not been ruled out as contributing to this effect.

There have been some inconsistencies in terminology in the literature. For instance, Fisher et al. (2004) referred to arbitrary, preferred stimuli as “competing” rather than “arbitrary” to emphasize that they effectively competed with engaging in the target response to receive the functional reinforcer. To test if these preferred stimuli were in fact competing, the authors conducted a competing stimulus assessment to measure duration of destructive behavior and interaction with each item that was identified as “preferred” on a paired-choice preference assessment. Methodologically, the competing stimulus assessment was a continuous NCR condition without extinction because subjects were given each item singly for a short period of time, and duration of engagement and destructive behavior were recorded. Reinforcers with high duration of engagement and low duration of destructive behavior were then selected for continuous NCR conditions that were compared to noncontingent attention, the maintaining reinforcer as identified by the functional analysis. Results indicated that both conditions suppressed behavior equally. However, because extinction was incorporated into both NCR conditions, we cannot determine if these reduction effects were due to the elimination of the attention contingency. Moreover, it is not surprising that the nonfunctional NCR conditions were effective in suppressing response rate because stimulus was previously demonstrated to decrease responding during the competing stimulus assessments. Stimuli that resulted in high rates of destructive responding during the assessment were not included in the treatment sessions, regardless of high levels of interaction with these stimuli.

More recently, as a treatment for SIB and food refusal, Wilder and colleagues (2005) incorporated continuous noncontingent access to a video that was identified as the HP on a forced-choice preference assessment. Results of the brief functional analysis identified that escape from food presentation maintained self-injurious responses of a two-year-old girl. During intervention, the participant was presented with continuous access to the video and a spoonful of baby food every 30 seconds, while engaging in food refusal continued to result in escape from food presentation. The authors suggested that NCR was effective in response suppression by altering the establishing operation for escape and concluded that the presence of the videotape may have made the food presentation less aversive. In contrast, Higbee, Chang, and Endicott (2005) demonstrated that NCR with the HP edible stimuli did not effectively suppress stereotypic responses maintained by automatic reinforcement, while a HP matching the presumed sensory reinforcer was effective. The reasons why the HP arbitrary reinforcer was not effective in this study, but had been in others, are unclear. One reason might be related to the fact that preference rankings for matched stimuli and edible stimuli were assessed in separate preference assessments but were never directly compared; that is, the relative contribution of preference remains unknown because it cannot be determined if the matched stimulus incorporated in the NCR condition was more preferred than the arbitrary, edible stimulus.

There are several issues in interpreting the results of the aforementioned studies. One issue is whether NCR truly involved arbitrary reinforcement. To confirm whether the reinforcers used were arbitrary, Fischer and colleagues (1997) incorporated an arbitrary reinforcement test. In an arbitrary reinforcement test, similar to a functional analysis, the subject is placed in a relatively deprived environment where the potentially arbitrary

reinforcer is only accessible contingent on the target behavior. If the response rate is as low in this condition as in the *alone* condition of the functional analysis, it is inferred that the reinforcer is arbitrary. The authors examined the effects of arbitrary NCR using a preferred stimulus identified by a preference assessment on SIB after conducting the arbitrary reinforcement test. Results indicated that the arbitrary reinforcer successfully reduced SIB across participants. However, there was no comparison between different levels of preference (e.g., HP versus LP), and the functional NCR procedure was not compared to the arbitrary NCR conditions. Hence, it is impossible to evaluate the relative contribution of preference in response suppression compared to the behavioral function.

Another limitation of NCR studies using arbitrary reinforcers is that in most studies, the effects of functional NCR in comparison to arbitrary NCR were not evaluated, in order to determine whether functionality or preference suppresses SIB more effectively. The exception is a study conducted by Cordaro and Bonem (2001), who investigated differences in response reduction during both conditions, while incorporating preference assessment and functional testing of the arbitrary and potentially functional reinforcers. However, this study did not manipulate different levels of preference to determine the function of preference. In order to understand how arbitrary NCR works, it is necessary to compare conditions using a preferred stimulus to NCR conditions that incorporate the behavioral function. Furthermore, only two studies in the literature (i.e., Cordaro & Bonem, 2001; Fischer et al., 1997) have incorporated an arbitrary reinforcement test to confirm that the stimulus used in the NCR procedure was a functional reinforcer for the target behavior, and in Cordaro and Bonem (2001), the test was inconclusive. NCR seems similar to other behavior-reduction

contingencies, in that preference has been identified as an important feature and may be more potent than functionally derived contingencies in reducing target responses.

There were several related purposes of the current study. One is to determine whether preference level of the presumed reinforcer within the NCR schedule will determine the degree to which the schedule will suppress behavior and whether one or the other method of determining preference better predicts such effects. Another is whether the relative preference level of the functional reinforcer determines its response-suppression value within the NCR schedule in comparison to NCR conditions using arbitrary stimuli. A third involves whether functionality contributes to the degree of response suppression independent of the relative preference for the functional reinforcer compared to other stimuli.

## Chapter 2: Method

*Participants and Setting*

Seven children with a history of high-rate problem behavior (i.e., a rate of at least once every two minutes) presumably maintained by tangible reinforcers were recruited from a preschool in Washtenaw County and a parent training group for children with autism at a regional hospital. Participants ranged in age from three to six years of age. All participants were screened using the Functional Analysis Screening Tool (FAST; Iwata & DeLeon, 1995). Six of these participants were identified by the FAST as having problem behaviors possibly maintained by tangible reinforcers. They were then screened with a standard functional analysis consisting of *attention*, *demand*, *tangible*, and *play* conditions. One child did not participate in the functional analysis phase because his parents reported that his problem behaviors occurred infrequently (i.e., less than once per day). Four children, based on their results of the functional analysis, were selected to participate in the preference-assessment phase. Two children completed all phases of the study.

Ethan was a four-year old boy diagnosed with autism and apraxia. He could say a handful of understandable words and signed approximately 50 words, consisting of mands for food and other tangible items. He received approximately 20 hours of applied behavior analysis (ABA) therapy and speech therapy per week. His target behaviors included screaming and hitting hard surfaces with his hand. Ethan's mother discontinued his participation after the preference assessment was completed due to schedule conflicts and her dissatisfaction with the timeliness of the study.

Chris was a four-year old boy diagnosed with autism, Chiari Type 1 Brain Malformation, and mixed developmental disorder. He could echo approximately 30 words,

but his spontaneous vocal language consisted primarily of one and two-word mands (e.g., “elephant,” “open door.” Chris attended a five-day intensive behavioral treatment at a center-based preschool for three hours per day. In addition, he received 30 hours of in-home ABA therapy, 20 hours of speech, and two hours of occupational therapy each week. His target behavior was tantrum behavior in the form of hitting hard surfaces (e.g., table or wall) with his hand.

Harry was a five-year old boy diagnosed with autism. He attended a full-day preschool in a self-contained classroom for children with early developmental delays. He received approximately 30 hours of ABA therapy at his home. He could speak approximately 50 words, consisting of mands for preferred items and breaks. Harry’s target behavior was aggression.

Dylan was a five-year old boy with autism who attended a full-day preschool in a self-contained classroom for children with early developmental delays. Dylan received intensive speech, occupational, physical, and ABA therapy each week. His target behaviors were SIB in the forms of headbanging, self-biting, and face slapping.

Sarah was a three-year old girl diagnosed with autism. She displayed no vocal speech, but could sign approximately 10 words, consisting of mands for preferred tangible items, such as book, video, and music. During the course of the study, Sarah and her father began attending an intensive parent-training group in ABA principles. Sarah’s parents also received weekly consultation with a behavior analyst. Sarah engaged in SIB in the form of self-hitting and headbanging and clothes wringing during tantrums.

Zeke was a five-year old boy diagnosed with autism and Disruptive Behavior Disorder Not Otherwise Specified (NOS). He spoke in two- to five-word sentences in

Spanish and English and both languages were regularly used in the home. His tantrum behaviors included SIB, property destruction, and aggression. Zeke's participation in the study was prematurely terminated during the arbitrary reinforcement test phase by the primary investigator because his target behaviors increased above baseline rates, increasing his risk and the risk of others.

All sessions were conducted in each child's home environment during simulated academic and social activities, with the exception of Chris, whose functional analysis was conducted in a treatment room at his center-based preschool. At each participant's respective homes, toys that were not used during the sessions were removed from the room or placed above the child's reach. The parents were not present except for two occasions during play conditions with Zeke. Sessions were conducted for one to two hours per day, one to three times per week.

### *Experimental Design*

There were five phases to the current study: (1) screening of participants, (2) functional analysis, (3) preference assessments, (4) arbitrary reinforcement test, and (5) NCR treatment conditions. The purpose of the screening phase was to identify children whose problem behaviors were thought to be maintained by tangible reinforcers. Functional analysis conditions were conducted to verify that the function of behavior was to receive tangibles. Following the functional analysis, two types of preference tests were conducted to identify four preferred items with varying levels of preference to be incorporated in the NCR treatment conditions. In addition, prior to the implementation of the intervention phase, arbitrary reinforcement tests were conducted with all four preferred stimuli to verify that they were in fact arbitrary and not functional reinforcers.



*Response Definitions, Data Collection, and Interobserver Agreement*

Target behaviors were tantrums of varying severity and topography and included SIB, aggression, property destruction, disruptive behavior, and clothes wringing. Ethan's tantrums included screaming, which was defined as emitting high-pitched vocalizations that were louder than conversational level, and hitting hard surfaces with an open palm. Zeke's property destruction consisted of throwing objects at least three feet, ripping objects, forcefully slapping hard surfaces (e.g., walls), and swiping objects off of a table or bookshelf. Harry and Zeke's aggression consisted of attempts to harm another person by hitting, kicking, pushing, biting, scratching, or throwing objects within one foot of the targeted person. Dylan, Zeke, and Sarah's SIB consisted of headbanging (forcefully contacting an object with the front or back of the head without the use of hands), self-hitting (forcefully contacting the face, legs, or stomach with the hands), and self-biting (contacting the arm or hand between the teeth). Sarah's clothes wringing was defined as grabbing her clothes with a closed hand while twisting, pulling, or lifting away from her body. Chris' target response was hitting tables (forceful contact between palm of hand and table).

Frequency counts were done by adding up all instances of the target behavior during each session. During competing stimulus assessments, data were collected using a 15-second partial interval recording system, in which observers recorded whether or not the child interacted with each stimulus or engaged in target behaviors during each interval. All data were graphed, and a systematic visual inspection (Parsonson & Baer, 1992) was used to determine the function of behavior during the functional analysis, confirm whether stimuli were nonfunctional in arbitrary reinforcement tests, and evaluate the effectiveness of each NCR procedure.

Two observers independently recorded the frequency of target responding for at least 30% of the functional analysis, paired-choice preference assessment, competing stimulus assessment, arbitrary reinforcement test, and NCR treatment conditions. Sessions were divided into 10-second intervals, and agreement on the occurrence and nonoccurrence of the target response was determined across all intervals. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Interobserver agreement was 99.8% across functional analysis conditions (range= 98% to 100%), 99% across paired-choice assessments (range= 99% to 100%), 97% across competing stimulus assessments (range= 80% to 100%), 99.9% across arbitrary reinforcement tests (range= 99% to 100%), and 99.8% across NCR conditions (range= 99% to 100%).

### *Materials*

#### *Functional Analysis Screening Tool.*

Caregivers or program staff administered the FAST (Iwata & DeLeon, 1995), a brief 20-item, paper-and-pencil instrument that assesses the antecedents and consequences of the target behavior (See Appendix C).

### *Procedures*

#### *Functional Analysis Conditions*

To confirm that the function of the target response for each participant was access to tangible stimuli, a functional analysis was conducted (Iwata et al., 1994). Conditions were presented in a multielement design, and all sessions were 10 minutes in duration. The condition order was randomized and predetermined prior to implementation. Functional analysis sessions were conducted until a stable pattern of responding was observed or the

child participated in 20 sessions. Two participants with target behaviors that were confirmed to be maintained by tangible reinforcers were selected for the experimental NCR conditions.

*Attention.* The therapist sat next to the child at a table or on a couch. The child was provided with two preferred toys that were identified by the parent as being moderately preferred. At the commencement of the session, the therapist told the child, “I have to do some work; you can play with your toys,” and then turned her head away from the child, while pretending to read a book or a magazine. Contingent on the target behavior, the therapist turned to the child and gave a mild verbal reprimand such as, “Please do not do that, you will hurt yourself.” After three seconds, the therapist turned away from the child again. This procedure was repeated contingent on further displays of the target behavior. Other than the target behavior, all inappropriate behavior (e.g., echolalia) was ignored.

*Demand.* The therapist sat across a table or preschool-sized desk from the child with academic materials. Materials that were deemed difficult to complete or aversive to the child, as assessed through caregiver report or the child’s current ABA therapy curriculum, such as puzzles, flashcards for receptive language, and shape sorters were included. The therapist asked the child to complete the task (e.g., “Put the puzzle together”). If the child did not comply within five seconds, then the therapist repeated the vocal prompt while providing modeling. If, after an additional five seconds, the child failed to initiate the appropriate response, the therapist used physical guidance to assist the child with completing the response by placing her hand over the child’s hand and engaging in the task. If, during any of these prompts, the child engaged in the target behavior, the therapist provided the child with a 30-second break. The break was signified by the therapist saying, “Okay, you do not have to,” removing the task materials from the child’s view, getting up from the table or desk, and

turning her back to the child for the 30-second allotted break. After the break, a new task was initiated. Praise was delivered if the child completed the correct response (e.g., putting the puzzle together) without physical guidance. The learning tasks were initiated as often as allowed during the 10-minute session. All other inappropriate behavior was ignored.

*Tangible.* The therapist sat across a table from the child while holding the presumed maintaining reinforcer or stood within five feet from the child while holding a remote control if the stimulus included in the condition was a television (for Sarah and Zeke). Immediately prior to the session, the child was permitted to play with the presumed functional reinforcer as identified by caregiver or teacher report for 60 seconds. After 60 seconds elapsed, the therapist removed the item from the child. This stimulus was in the child's view at all times. Contingent on the target response, the therapist delivered access to the stimulus for 30 seconds. After 30 seconds had elapsed, the item was removed again. This procedure continued until the session was terminated. If the child walked away from the table during the session, he or she was not prompted to remain seated. All inappropriate behaviors in addition to the target behavior were ignored.

*Play.* This condition served as the control procedure. The therapist was present in the room and maintained close proximity (i.e., at least two feet) with the child. There were a variety of toys in the room that were identified as preferred via caregiver or teacher report. The presumed functional reinforcer used in the *tangible* condition was not available during this condition. The therapist presented no educational tasks or vocal prompts and provided noncontingent attention in the form of praise at least once every 30 seconds (e.g., "I love the way you are playing with your blocks"). The child was allowed to freely move around the room. No programmed contingencies were in place for target responses.

*Preference Assessments*

*Paired-Choice Preference Assessment.* A paired-choice reinforcer preference assessment was conducted as outlined by Fisher et al. (1992) to determine a hierarchy of preference for 16 stimuli. Fifteen preferred items identified by caregiver report, plus the maintaining reinforcer used in the *tangible* condition were assessed. The child was not given access to stimuli for at least one hour prior to the preference assessment. Immediately prior to the start of the assessment, the child was prompted to interact with each stimulus for 30 seconds. For each trial, two stimuli were placed in front of the participant while the therapist and child sat at a table. Each stimulus was paired once with every other stimulus, presented in a randomized order. Attempts to select both stimuli were blocked and the pair was re-presented. An approach response was defined as the participant placing his or her hand on either of the stimuli presented during a trial. A hierarchy of preference was calculated by dividing the number of trials in which a stimulus was approached by the number of trials it was presented and multiplying by 100%. The functional reinforcer, HP, LP, and two moderately preferred (MP) items were selected for use in the subsequent competing stimulus assessment and arbitrary reinforcement test conditions.

*Competing Stimulus Assessment.* A second measure of preference was conducted, based on the procedures outlined by Fisher et al. (2004), to determine duration of interaction with the five items selected from the paired-choice assessment (i.e., functional reinforcer, HP, LP, and two MP) and occurrence of target responding. Each stimulus was presented singly in front of the participant for five minutes. No other toys or food were available in the room. At the beginning of each session, the therapist handed the object to the child and provided a tact (e.g., “here is a doll”). No prompts to interact with the toy were provided.

Engagement was defined as placing at least one hand on the object at any time during the interval or orienting his or her face to the television if a video was the leisure item being evaluated.

#### *Arbitrary Reinforcement Test*

The purpose of this condition was to ensure that the reinforcers used in the NCR-arbitrary condition were not functional reinforcers (Fischer et al., 1997). A multiple-sequential withdrawal design was implemented with four or five preferred stimuli selected from the paired-choice preference assessment (see Table 1 below). In the “A” condition, a baseline condition was conducted that was identical to the *play* condition in the functional analysis. During baseline, the functional reinforcer and four stimuli selected for NCR sessions were not in the room, and the therapist delivered vocal social praise at least every 30 seconds. In the experimental conditions, the therapist was present and delivered the preferred stimulus contingent on the target response. The preferred item was in the child’s view at all times throughout the session. The preferred item was considered arbitrary if levels of responding were comparable to those observed in the play condition. If rates of responding were higher in the test condition, it was inferred that the preferred item was a function of the response. In this case, the item with the next highest ranking of preference was included in an additional arbitrary reinforcement test (for Chris only). Due to an increase in Zeke’s target responding during the arbitrary reinforcement test phase, his participation was discontinued after the HP condition.

Table 1

*Order of conditions in arbitrary reinforcement tests for Chris, Sarah, and Zeke. At least three sessions were presented in each condition. Conditions were presented in a multiple-sequential withdrawal design in a randomized order across participants.*

	<b>Chris</b>	<b>Sarah</b>	<b>Zeke</b>
<b>Conditions</b>	1. Baseline	1. Baseline	1. Baseline
	2. Elephant (HP)	2. Farm (MP)	2. Fish tank (MP)
	3. Baseline	3. Baseline	3. Baseline
	4. Zurg (LP)	4. Dora doll (MP)	4. Bubbles (HP)
	5. Baseline	5. Baseline	
	6. Buzz car (MP)	6. Weebles (LP)	
	7. Baseline	7. Baseline	
	8. Jack-in-the-box (MP)	8. Bubbles (HP)	
	9. Baseline		
	10. Stuffed Buzz (HP)		

*NCR Treatment Conditions*

All NCR conditions were presented in a reversal design. The order of treatment conditions varied across participants in order to reduce order effects. NCR-Functional and each NCR-Preferred condition were continued until there was a stable pattern of responding or seven sessions had elapsed. All sessions were 20 minutes in duration. The rate of delivery of the reinforcer was predetermined prior to the implementation of any NCR sessions by calculating the rate of responding during the tangible condition of the functional analysis. The reinforcer was delivered as many times per minute as the mean rate of the response in the functional analysis condition. Since there was no extinction component in place, the

functional reinforcer was delivered contingent on the target response during all treatment conditions. For Chris, reinforcers were delivered on a fixed-interval 15-second schedule. For Sarah, reinforcer delivery was on a fixed-interval 90-second schedule.

*Baseline.* This condition was identical to the tangible condition of the functional analysis, in which the therapist delivered the functional reinforcer for 30 seconds, contingent on the target response.

*NCR-Functional.* The therapist delivered the maintaining reinforcer used in the functional analysis according to a predetermined schedule. Each time the reinforcer was delivered, participants were allotted 30-second access to manipulate the item. It was expected that rates of behavior should decrease to levels near zero because the child no longer needs to engage in the target response in order to receive the maintaining reinforcer. Because extinction was not in place, if the child engaged in a target response, the therapist provided 30-second access to the functional reinforcer.

*NCR-Preferred.* This condition was identical to the NCR-Functional condition except that the therapist delivered an arbitrary and preferred item instead of the functional reinforcer on a time-based schedule. Three levels of preference were compared, one in each condition (i.e., HP, MP, LP). The order of the preference in NCR-preferred conditions was randomized across participants. Each time the reinforcer was delivered, participants were allotted 30-second access to manipulate the item. If the child engaged in a tantrum, the therapist delivered the functional reinforcer for 30 seconds. Thus, at times the reinforcer delivery of a preferred stimulus overlapped with access to the functional reinforcer.



## Chapter 3: Results

Figures 1 and 2 show the results of the functional analysis for all participants, the first experimental phase of the study. Functional analyses revealed that target responding occurred at consistently higher rates in the *tangible* conditions than other conditions for Ethan, Chris, Sarah, and Zeke, clearly indicating that they tantrumed in order to receive access to a tangible reinforcer. Functional analyses were inconclusive for Harry and Dylan, with responding occurring at zero or near zero levels across conditions. Given these results, Harry and Dylan were excluded from participation in the remaining phases of the study.

Figure 3 shows the results of the paired preference assessment for Chris and Sarah. The functional reinforcer was chosen most frequently by three of four participants. Chris ranked the following items in order from most to least preferred: elephant (100% of trials), soft car (87% of trials; functional reinforcer), stuff Buzz (80% of trials), Lego car (67% of trials), book (67% of trials), train (60% of trials), little Buzz (53% of trials), Buzz car (47% of trials), Jack-in-the-box (40% of trials), dinosaur (33% of trials), flat ball (33% of trials), phone (33% of trials), Jesse doll (33% of trials), Buzz mobile (27% of trials), Woody doll (20% of trials), and Zurg doll (13% of trials). Sarah selected the following items in order from most to least preferred: video (100% of trials; functional reinforcer), bubbles (87% of trials), Leapfrog (73% of trials), music toy (67% of trials), puzzle (60% of trials), See 'N Say (53% of trials), doll with bed (53% of trials), Dora the Explorer doll (53% of trials), farm (47% of trials), sign book (47% of trials), book (33% of trials), CD player (33% of trials), maraca (27% of trials), blanket (20% of trials), and Weebles (20% of trials).

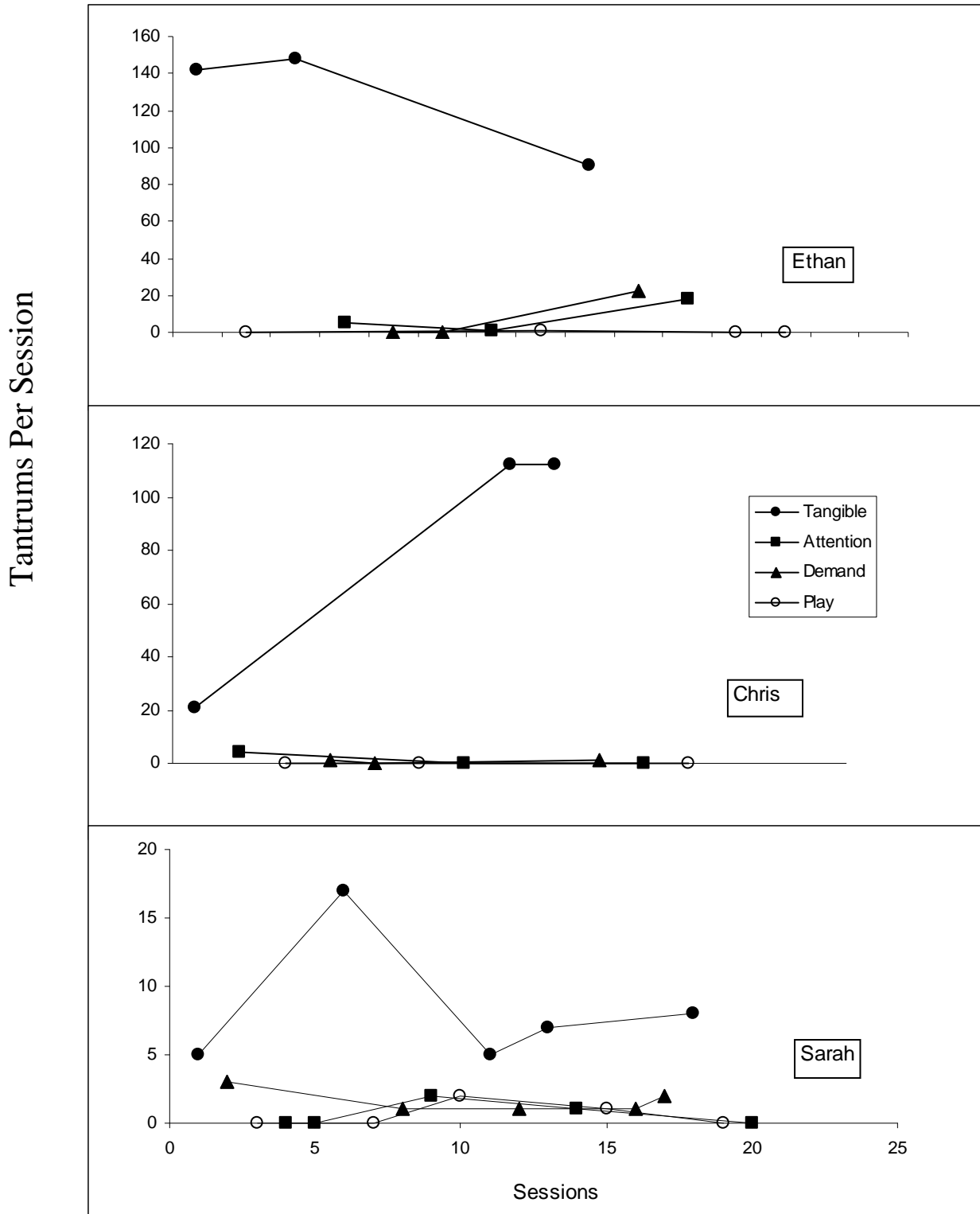


Figure 1. Results of the analogue functional analysis for Ethan, Chris, and Sarah across *tangible*, *attention*, *escape*, and *play* conditions. All sessions were 10 minutes in length. Note: Ranges on the y-axis differ across participants.

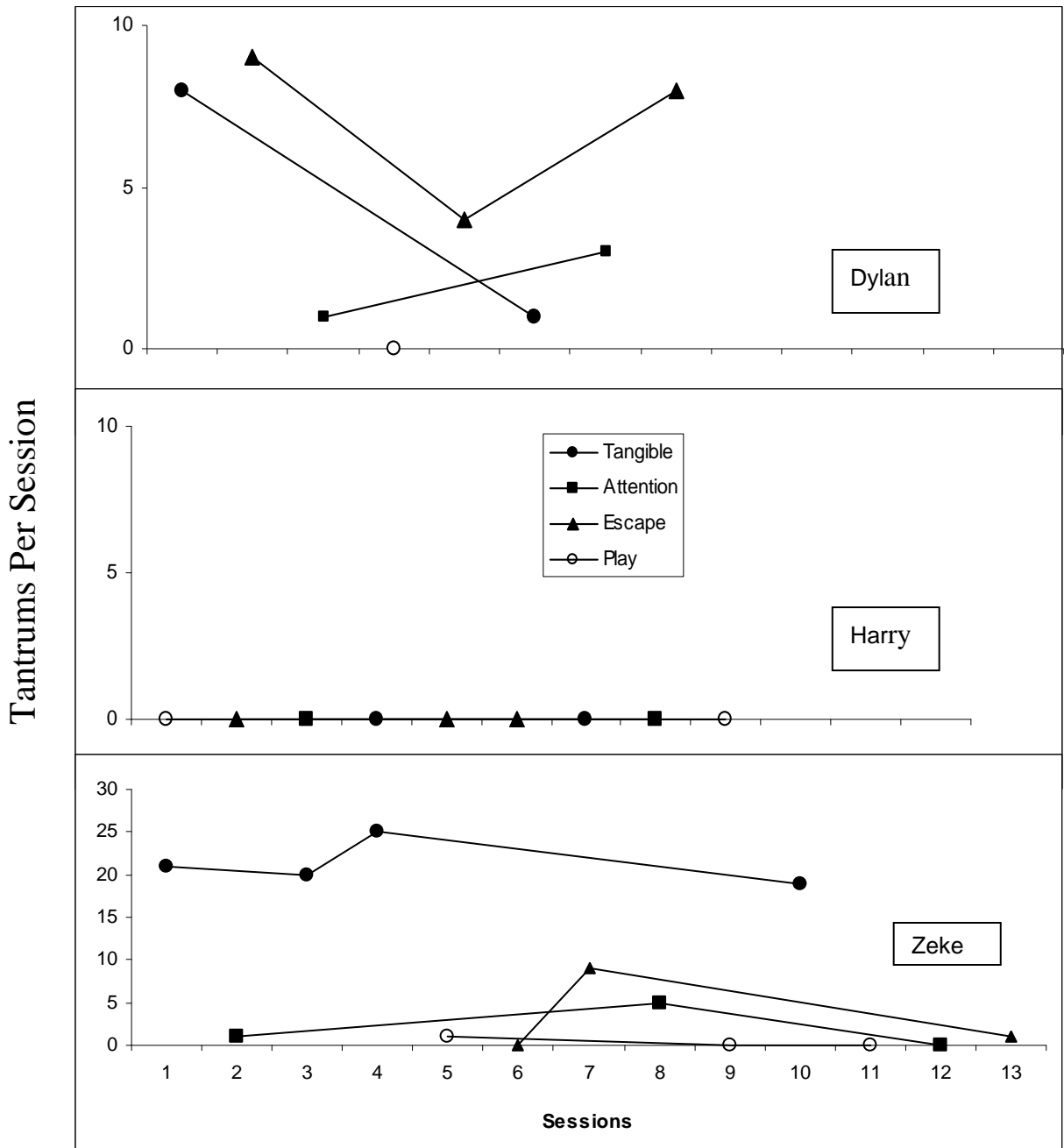


Figure 2. Results of the analogue functional analysis for Dylan, Harry, and Zeke across *tangible*, *attention*, *escape*, and *play* conditions. All sessions were 10 minutes in length. Note: Ranges on the y-axis differ across participants.

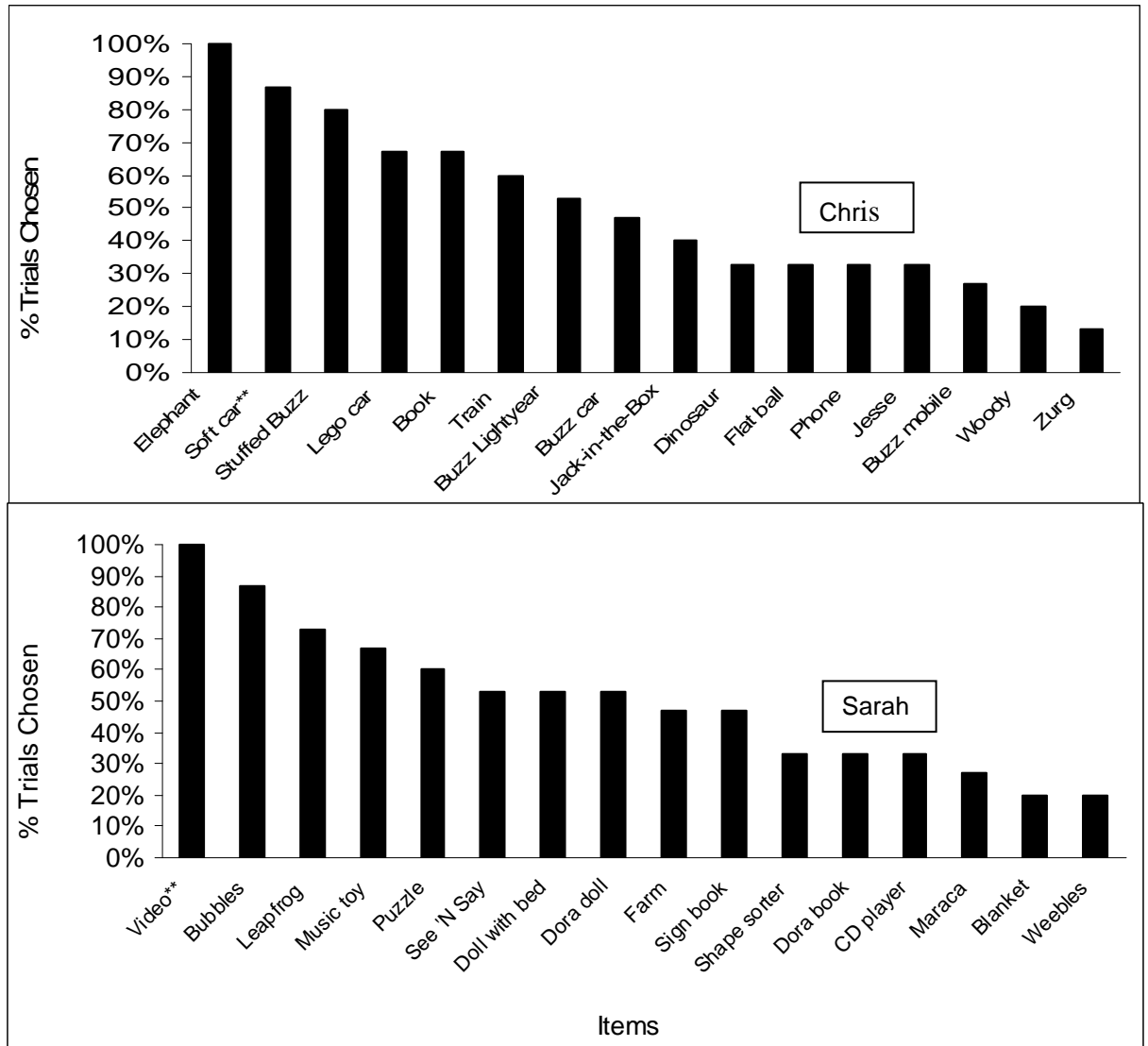


Figure 3. Results from the 16-item paired-choice assessment for Chris and Sarah. Functional reinforcers are denoted with \*\*.

Ethan and Zeke’s data from the paired-choice preference assessment are shown in Figure 4. Ethan chose the following stimuli in ranked order from most to least preferred: Magnadoodle (80% of trials; functional reinforcer), soap (80% of trials), candle (80% of trials), rainstick (80% of trials), dolphin (60% of trials), ball (60% of trials), markers (53% of trials), star ball (53% of trials), pipe star (47% of trials), Leapster (40% of trials), book (40%

of trials), Play Doh (33% of trials), blocks (33% of trials), flowers (27% of trials), bow (20% of trials), and broom (13% of trials). Zeke selected the following stimuli in ranked order from most to least preferred: video (100% of trials; functional reinforcer), bubbles (80% of trials), train set (80% of trials), Percy train (67% of trials), shoes (60% of trials), Thomas train (53% of trials), James train (53% of trials), fish tank (47% of trials), puzzle (40% of trials), book (40% of trials), monkey (40% of trials), ladybug (33% of trials), spinning top (33% of trials), coin dispenser (20% of trials), bug (13% of trials), and crocodile (7% of trials).

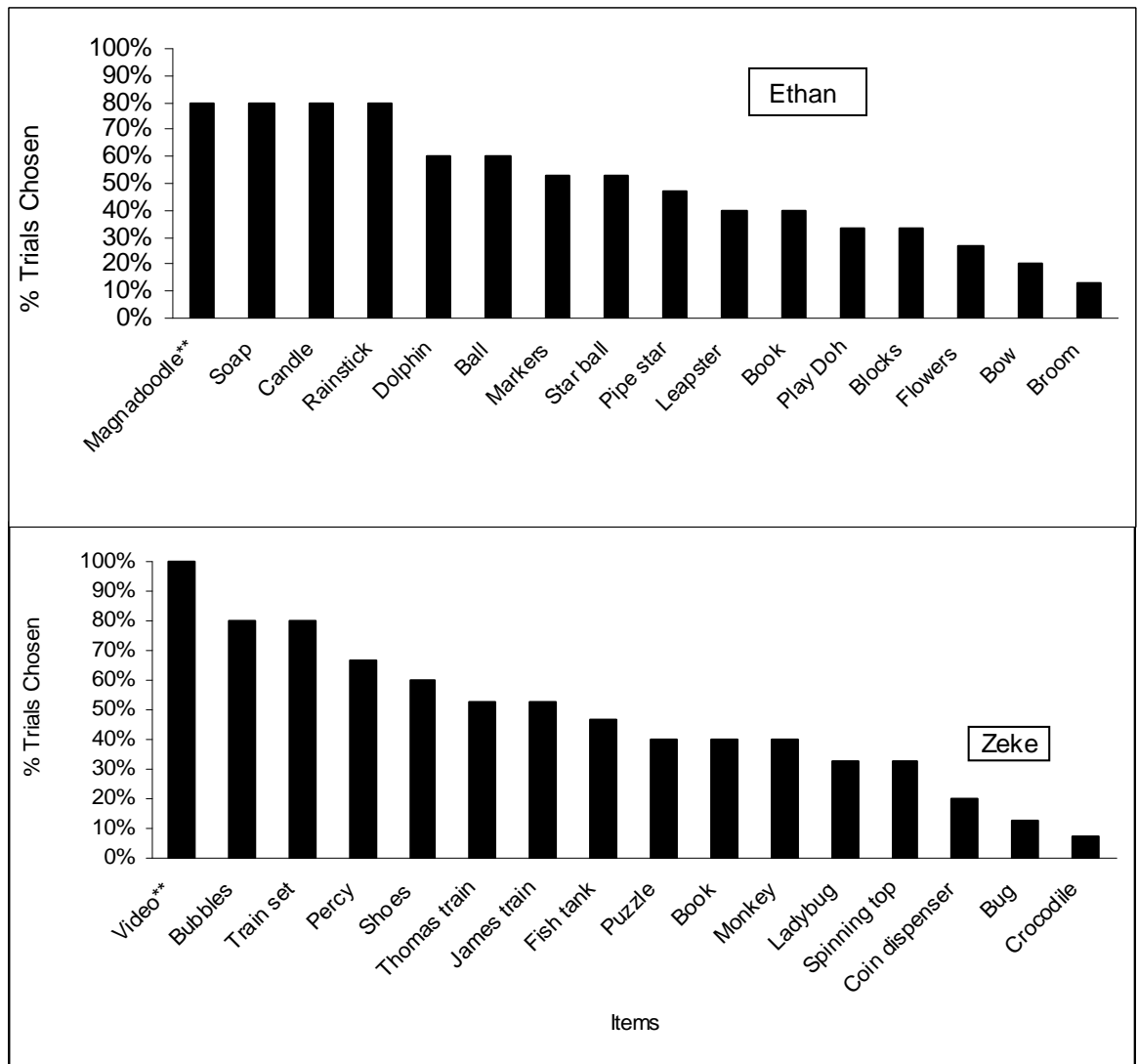


Figure 4. Results from the 16-item paired-choice assessment for Ethan and Zeke. Functional reinforcers are denoted with \*\*.

During competing stimulus assessments, all participants engaged with the functional reinforcer for 100% of intervals and interacted with the LP for longer durations than most MP (see Figure 5). Chris interacted with the elephant (HP) for 100% of intervals, Stuffed Buzz for 100% of intervals (HP2), soft car (functional reinforcer) for 100% of intervals, Buzz car for 100% of intervals (MP), Jack-in-the-box (MP) for 15% of intervals, and Zurg doll (LP) for 60% of intervals. Chris engaged in zero instances of target behavior throughout all sessions. Sarah engaged with the video (functional reinforcer) for 100% of intervals, bubbles (HP) for 30% of intervals, Dora the Explorer doll (MP) for 20% of intervals, farm (MP) for 15% of intervals, and Weebles (LP) for 90% of intervals. She engaged in zero instances of target behaviors across all sessions, with the exception of the delivery of the Dora doll, in which she engaged in clothes wringing and SIB during 15% of intervals. Zeke interacted with the video (functional reinforcer) during 100% of intervals, bubbles (HP) during 100% of intervals, fish tank (MP) during 5% of intervals, Thomas train (MP) during 15% of intervals, and crocodile (LP) during 70% of intervals. Zeke engaged in target behaviors during all assessments. He engaged in tantrum behaviors during 10% of intervals with the video, 10% of intervals with the bubbles, 35% of intervals with the fish tank, 60% of intervals with the Thomas train, and 30% of intervals with the crocodile.

During the arbitrary reinforcement tests (see Figure 6), Sarah engaged in zero instances of the target responses during all baseline and experimental conditions, indicating that all preferred stimuli were most likely arbitrary and not functional. Chris engaged in zero rates of the target response during all baseline, Zurg (LP), and Jack-in-the-box (MP) conditions. His responding during the HP condition was variable, in which he engaged in zero rates of responding during two nonconsecutive sessions and between 16 and 24

instances per session in the other two sessions in that phase. Due to the increased responding observed during the delivery of the HP, the next highest ranked stimulus (Stuffed Buzz) as determined by the paired-choice procedure was evaluated. Chris also engaged in near zero rates of tantrums in the Buzz car (MP) and Stuffed Buzz (HP) conditions, indicating that both stimuli were arbitrary. Zeke engaged in high rates of tantrums across all conditions, including some sessions during baseline; therefore, Zeke's participation in the current study was discontinued due to the increased risk for himself and others.

Percentages of Intervals

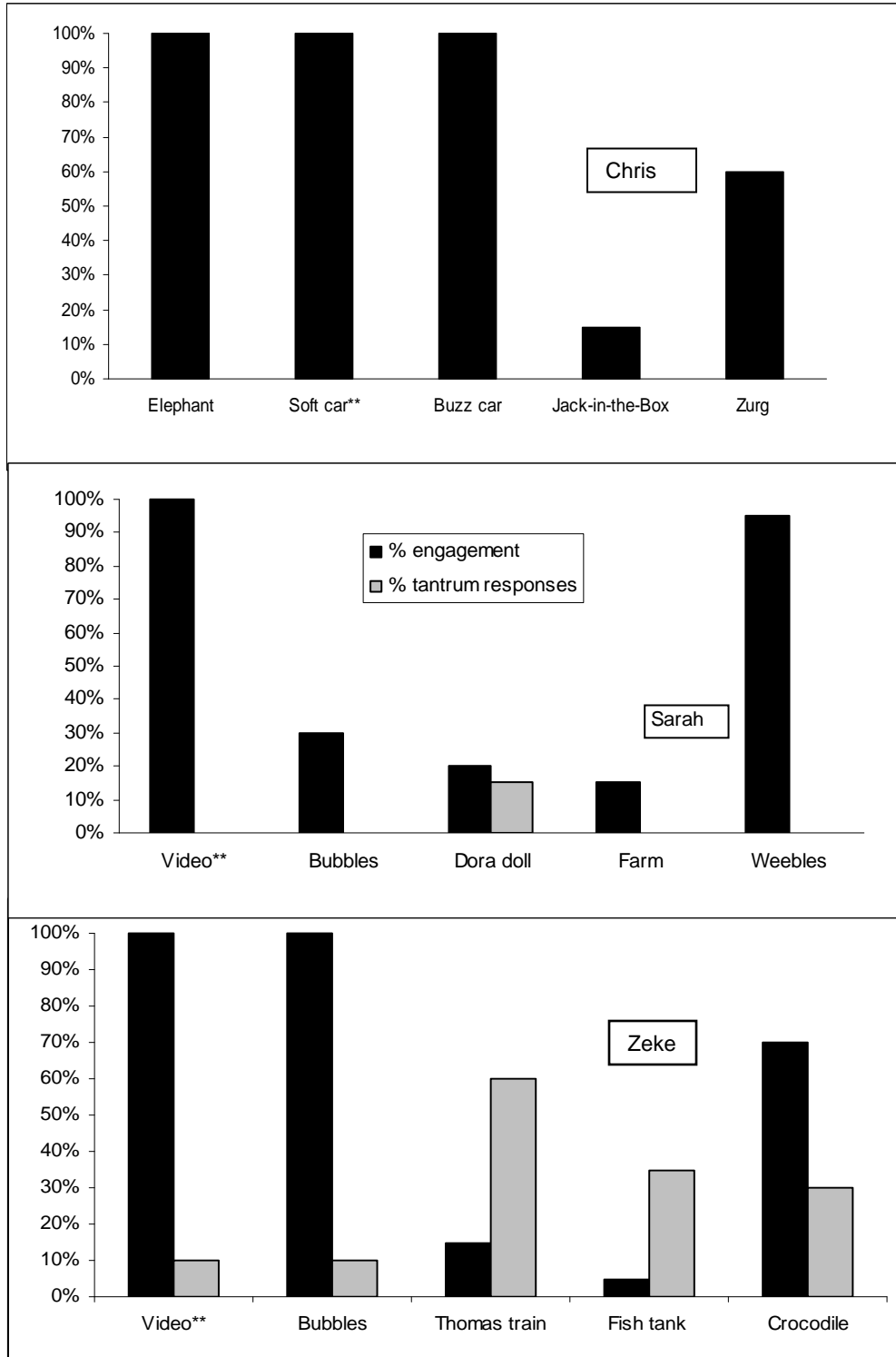


Figure 5. Results from the competing stimulus assessments for Chris, Sarah, and Zeke. Functional reinforcers are denoted with \*\*. All sessions were five minutes in duration, consisting of 20 intervals lasting 15 seconds each. Black bars represent engagement and gray bars indicate percentage of tantrums. Note: Items on x-axis are ordered from highest to lowest preferred.



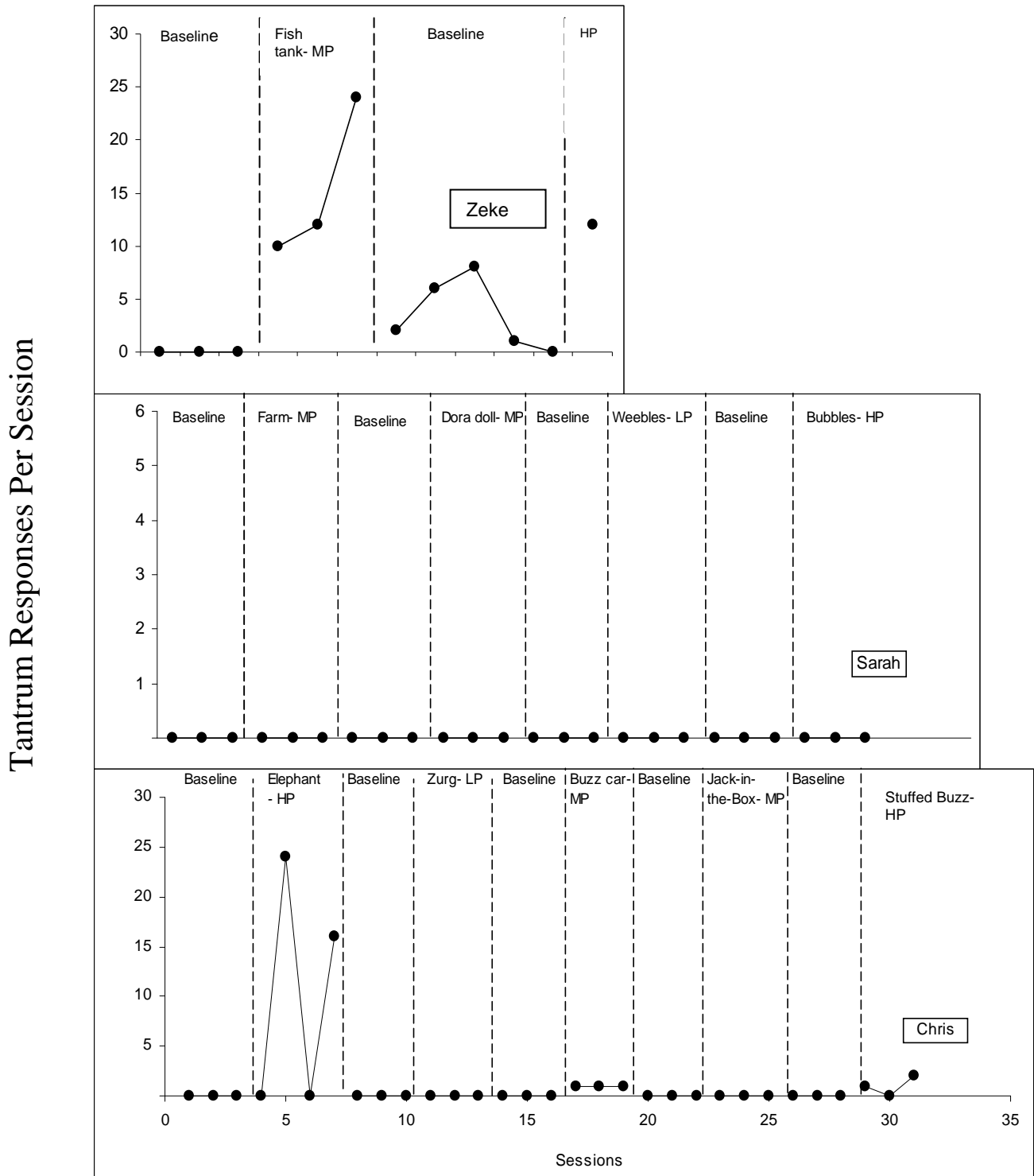


Figure 6. Results from the arbitrary reinforcement tests for Zeke, Sarah, and Chris. All sessions were five minutes in duration. Functional reinforcers are indicated by the “FX” abbreviation. Note: Y-axis ranges differ across participants.

As seen in Figure 7, results from the experimental NCR conditions indicated that response suppression occurred all conditions. Sarah's responding was similar to the tangible condition of the functional analysis, in which she engaged in tantrums approximately once per minute ( $M = 22.8$  per session). During the NCR-Preferred condition with the MP (i.e., Dora doll), Sarah's responding decreased to zero for two consecutive sessions. In addition, complete suppression of Sarah's clothes wringing and SIB was observed for two consecutive sessions during the LP condition. During the delivery of the functional reinforcer, Sarah's target responding decreased by approximately 50% compared to baseline rates. Her responding was variable during the HP condition and initially increased to baseline levels before a 50% reduction was observed in the last two sessions.

During baseline, Chris engaged in high rates of tantrum behavior, engaging in approximately 110 instances per session ( $M = 110.67$ ). His responding during the LP condition was variable, but it was consistently lower than baseline and decreased to almost zero-levels for two consecutive sessions before increasing. During the delivery of the functional reinforcer, Chris' responding was stable, decreasing by approximately 70% compared to baseline. Chris' responding during the MP condition decreased by approximately 80% on average and was near zero levels during one session. During the HP condition, his responding decreased to zero for two consecutive sessions.

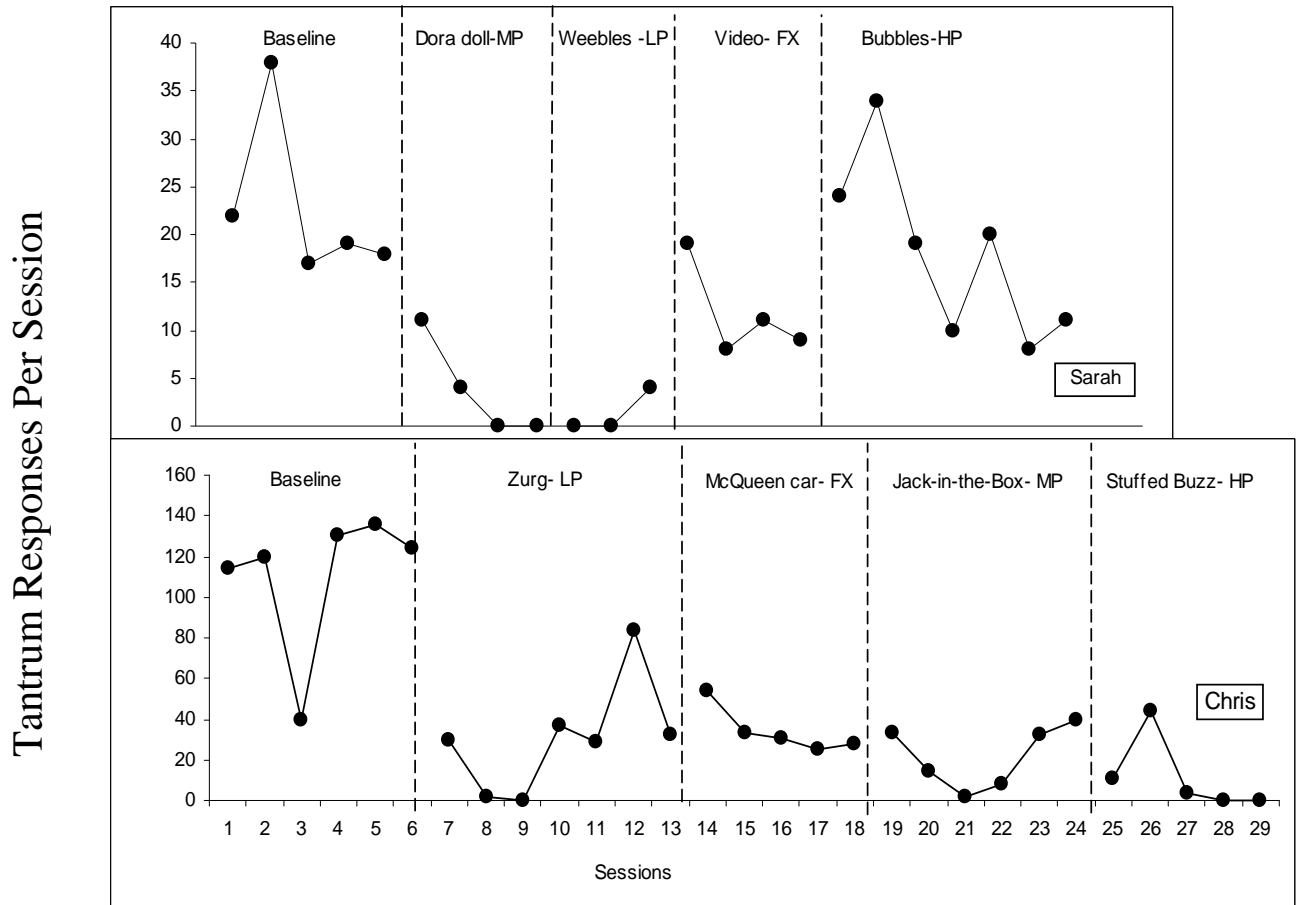


Figure 7. Results from NCR conditions for Sarah and Chris. All sessions were 20 minutes in duration. Functional reinforcers are indicated by the “FX” abbreviation. Note: Y-axis ranges differ across participants.

## Chapter 4: Discussion

The current study extends the findings of Fisher and colleagues (1997) and Lalli et al. (1997), demonstrating that NCR without an extinction component can suppress responding to levels near zero. Lower levels of responding were observed in NCR-functional and all NCR-preferred conditions. However, there were no differences in suppression based on preference level across participants. NCR resulted in complete suppression for Sarah in the LP and MP conditions, while her responding increased to baseline levels initially during the HP condition and then reduced over time. This pattern was not predicted by her relative preference, which would predict the delivery of the HP would result in lower levels of responding compared to the delivery of the MP and LP. In addition, data indicate that the delivery of the functional reinforcer in the NCR-Functional condition did not lead to complete suppression for either subject. For Chris, all conditions resulted in at least a 70% decrease from baseline levels. However, During the LP condition, NCR had short-term effects, suppressing responding to levels near zero for two sessions and then losing its suppressive effects. Although Chris' average level of responding was lowest in the HP condition, in which he engaged in zero levels of responding for two consecutive sessions, it is unknown whether the HP would have lost its suppressive effects over time. The results across participants contrast the results obtained by Fisher and colleagues (2000), in which the delivery of the HP without a combined extinction component resulted in an immediate decrease in target responding to levels near zero, while the delivery of the LP resulted in similar responding to baseline.

Several factors could explain why complete response suppression did not occur when the functional reinforcer was delivered. First, the reinforcer delivery rate was determined by

calculating the interresponse time for each participant during baseline. However, NCR has been demonstrated to be less effective when the reinforcer delivery in baseline and experimental conditions are yoked (e.g., Ringdahl, Vollmer, Borrero, & Connell, 2001). All NCR conditions may have been more effective if continuous schedules were implemented in initial sessions and then thinned. Furthermore, NCR has been shown to be less effective when stimuli are not varied. DeLeon, Anders, Rodriguez-Catter, and Neidert (2000) found that NCR with the HP lost its effectiveness over time, suggesting that NCR schedules with multiple stimuli are more likely to compete with the functional reinforcer. Although the participant's SIB was automatically-maintained, the authors observed that the duration of the participant's engagement with the item decreased substantially across sessions and she no longer approached the toy outside of session. These results parallel some of the observations of Chris' behavior. That is, when delivered a preferred stimulus or the functional reinforcer, Chris often cried, threw the toy following its delivery, and sat with nothing to engage with for the remainder of the interval. In DeLeon et al. (2001), the authors presumed that NCR lost its effectiveness due to satiation, yet satiation does not provide a comprehensive account for the results observed in the present study.

According to applied literature, satiation is the proposed operating mechanism for observed behavior change in NCR schedules. However, some authors argue that this term only applies to consumable reinforcers because the presentation of nonappetitive reinforcers does not result in physiological changes as seen in repeated food and water intake (e.g., McSweeney & Murphy, 2000; Michael, 2000; Murphy, McSweeney, Smith, & McComas, 2003), a criticism that is consistent with other scientific disciplines. Although satiation may explain why Chris did not interact with preferred stimuli or the maintaining reinforcer from

the functional analysis during later sessions, the satiation hypothesis does not explain why he continued to engage in the target response throughout all conditions. In addition, if the principle of satiation does not operate with nonconsumables, the results of the present study may not have generality to edible reinforcers. A replication of this study with edible reinforcers with a larger sample size (i.e., at least four to six participants) is needed to better understand how preference influences response suppression. The sample size in the current study was too small to detect any patterns in response suppression across preference level based on either preference test.

A more plausible interpretation as to why reinforcers lost their effectiveness during sessions with Chris is that he may have habituated to the reinforcers during the NCR-Preferred conditions. Habituation, defined as a reduction in responsiveness to a stimulus after the repeated presentation of that stimulus across time, has been argued to be a more useful description of decreases in reinforcer effectiveness than satiation and extinction (McSweeney & Murphy, 2000; Murphy, et al., 2003). Habituation occurs more rapidly when items are presented within a fixed-interval schedule (McSweeney & Murphy, 2000). NCR sessions were 20 minutes in duration, lasting twice as long as reported in other studies (e.g., Fischer, et al., 1997; Fisher, et al., 2004). Although it is unclear whether habituation to the reinforcers would have occurred if session lengths were only five or ten minutes in duration, habituation is likely because participants would have contacted frequent presentations of all reinforcers. Although during NCR it is expected for the functional reinforcer to weaken through the process of habituation, in the current study Chris habituated to the alternative, preferred stimuli instead of the functional reinforcer. During the LP condition for Chris and the HP condition for Sarah, increases in target responding may have been due to sensitization, the

process by which the responsiveness to a stimulus increases when it is presented (Murphy et al., 2003). Habituation and sensitization better account for the effects observed during NCR schedules in the present study than satiation. While these processes explain both the increases and decreases in response rate between sessions, the concept of satiation can only describe reductions in responding (Murphy et al., 2003). Furthermore, the satiation hypothesis does not predict why responding sometimes increased after the repeated delivery of a reinforcer over time, while habituation and sensitization describes these fluctuations in responding.

Punishment may also explain some of the effects observed during the NCR conditions. For instance, it is possible that the toy used in the functional analysis became a conditioned punisher for Chris during all NCR conditions. As noted previously, Chris often threw the toys after they were delivered and chose to sit with no stimuli to manipulate for the remainder of the interval. In addition, he often cried when the functional reinforcer was delivered, even during NCR-Preferred conditions, in which he engaged in the target response in order to gain access to the functional reinforcer. Moreover, since this study only used nonconsumable reinforcers, all NCR procedures may have been punishing because the children had to relinquish the toys after the 30-second access had elapsed. Therefore, different results may have been obtained with edible reinforcers, as they would not have to have been taken away.

There are only a handful of studies that have examined the assessment and treatment of problem behaviors maintained by tangible reinforcement (i.e., Fisher, Kuhn, & Thompson, 1998; Hagopian et al., 2000; Hagopian, Wilson, & Wilder, 2001; Lalli & Kates, 1998; Marcus & Vollmer, 1996). One reason for this lack of research may be related to methodological issues. For instance, the *alone* condition was excluded from the functional

analysis in the current investigation because all children would frequently mand and tantrum for the functional reinforcer when it was not available. This occurred during some of the other standard functional analysis conditions such as the *play* condition and during breaks. Although Iwata and colleagues (1994) presume that target responding is maintained by automatic reinforcement or multiple causes when high rates are observed during *alone* conditions, it is difficult to tease apart whether an elevated rate of responding is due to the child being denied access to a preferred stimulus or sensory reinforcement. A more useful test condition to confirm that target responses were not maintained by automatic reinforcement may have been a *no-consequence* condition as outlined by Athens, Vollmer, Sloman, and St. Peter-Pipkin (2008), in which toys continued to be present, but no social contingencies were in place for target responding. Similar to the participant in Athens et al. (2008), parents indicated that the participants in the current study did not have a history of being in impoverished environments and toys were available continuously at home.

There were also methodological concerns with the arbitrary reinforcement tests. Fischer and colleagues (1997) used *alone* conditions as a baseline; however, *alone* conditions would not have been a valid measure of baseline in the current study because the participants most likely would have engaged in high rates of responding. Moreover, Zeke engaged in elevated rates of property destruction and aggression during the competing stimulus assessments and arbitrary reinforcement tests. These behaviors did not decrease when preferred stimuli were delivered. Thus, it appears that none of the preferred stimuli were arbitrary; however, during these conditions Zeke would mand for the functional reinforcer, indicating that the results from the arbitrary reinforcement test may not have been valid. It is possible that his increased responding was due to an extinction burst. Unlike the *tangible*



conditions of the functional analysis, Zeke had no opportunity to engage with the functional reinforcer during this phase of the study. Whenever he engaged in a target response during the arbitrary reinforcement test, he was not given access to the video, which was essentially an extinction procedure. Although not addressed in the applied literature, arbitrary reinforcement tests may not be suitable for some children whose problem behaviors are maintained by tangibles. Although Fischer and colleagues (1997) achieved consistent results during their arbitrary reinforcement test, target responses were attention-maintained.

The duration of engagement during the competing stimulus assessments did not consistently correspond to the level of preference obtained in the paired-choice method across participants. That is, the higher the stimulus ranked in the hierarchy did not always predict how long the child interacted with it. Hagopian, Long, and Rush (2004) recommend using engagement-based assessments when identifying preferred nonedible reinforcers, yet competing stimulus assessment did not more accurately predict response suppression during NCR schedules. Discrepancies between different methods of assessing preference have been documented in the empirical literature. For instance, DeLeon, Iwata, Conners, and Wallace (1999) compared multiple stimulus without replacement (MSWO), a choice methodology, to the single stimulus engagement procedure (SSE), an engagement measure in which subjects were presented with a single stimulus for two minutes. Results indicated that the engagement measure yielded a more discriminated hierarchy of preference than the MSWO approach. In addition, Hagopian, Rush, Lewin, and Long (2000) found that the results of the paired-choice and SSE assessments were consistent in only two of four participants. Results also indicated that paired-choice assessments yielded more stable results across repeated administrations

than the SSE procedure. Hence, advantages and disadvantages are noted with both choice and engagement formats.

One potential reason that the two measures of preference do not yield a strong correspondence is that they yield different types of data. Paired-choice preference assessments yield ordinal data, thus there is no specification of the degree of preference between ranked items. For instance, it is unknown how much more preferred a second ranked item is than a third ranked item. Duration measures provide continuous data, allowing researchers to calculate a more differentiated hierarchy. Nonetheless, neither method was a better predictor of the results of the NCR conditions in the current study. Thus, these findings suggest that preference-assessment methods may not consistently identify potent reinforcers for response suppression contingences.

Although some studies suggest that preference is unstable across time (e.g., Premack, 1962; Zhou, Iwata, Goff, & Shore, 2001), Hanley, Iwata, and Roscoe (2006) found that choices for leisure items were consistent across three to six months in seven of ten participants with developmental disabilities. Therefore, it is unclear whether the inconsistency across measures in the present study was because paired-choice and competing stimulus assessments were conducted on separate days. Hanley and colleagues also demonstrated that preference results were idiosyncratic between subjects, and preference rankings could be manipulated through respondent conditioning and motivating operations. Because the participants in the present study were delivered stimuli repeatedly across several prolonged sessions, alterations in preference rankings may have occurred during the course of NCR treatments. Given that it is likely habituation occurred, a potential limitation is that administrations of paired-choice and competing stimulus assessments were not repeated

during the treatment phase in order to determine if reinforcers lost their effectiveness or changed in preference value.

Besides temporal parameters, preference is also affected by contextual variables. For example, Premack (1962) demonstrated that reinforcement relations can be reversed by first increasing running with water access, then later increasing drinking by making it contingent on running in four Sprague-Dawley rats. This manipulation indicates that preference can change systematically based on the contingency in place. Therefore, the term *preference* is relative and can be influenced by many environmental variables that are typically unaccounted for in applied research. Contextual variables could not be controlled for in the current study, and it is possible that responding during NCR conditions was affected by changes in the participants' environments that were unknown to the experimenter. In addition, the presumed functional reinforcer identified in the functional analysis may have no longer been responsible for behavioral maintenance, especially in the case for Chris who often did not interact with the functional reinforcer when it was delivered. An unknown reinforcer that was not part of the treatment may have maintained his responding.

The present investigation is the first to directly assess the preference value of tangible functional reinforcers and is one of the first steps in developing methods to assess other types of reinforcers, such as attention and escape. The development of such preference methods are needed to help bridge the gap in research between function and preference in behavior reduction techniques, in order to better understand how these contingencies work. Although current empirical guidelines emphasize the use of functional analysis to determine the functional reinforcer that is implemented in response suppression contingencies (Iwata & Dozier, 2008), preferred stimuli identified through preference assessments have also been

demonstrated to reduce response rates when incorporated into differential reinforcement schedules (e.g., Fisher, Kuhn, & Thompson, 1998; Ringdahl et al., 2002). Nonetheless, due to methodological limitations, the preference level of nontangible reinforcers (i.e., attention and escape) has only begun to be evaluated. In the only study to date to evaluate the preference value of nontangible reinforcers, Berg and colleagues (2007) conducted functional analyses to determine the function of behavior and then evaluated the preference rankings of escape from instructions, adult attention, and preferred leisure items in a paired-choice assessment. Two tables were arranged next to each other with stimuli associated with each functional analysis condition placed on them. For example, access to teacher attention and preferred leisure items was represented at a table in which the teacher sat with the leisure items. Results indicated that functional analysis and preference assessment results were consistent for three of four participants. The maintaining reinforcer identified by the functional analysis was more effective in reducing target responding than the preferred reinforcer when delivered in a treatment package. These results suggest that preference and function may sometimes correspond, but not always.

The current study has external and ecological validity. With the exception of Chris' functional analysis, all sessions were conducted at the homes of the participants. Although experimental control may have been maintained better if these procedures had been conducted in a research laboratory setting, these data indicate the power of behavioral interventions and assessment techniques in applied settings.

The current study demonstrates that NCR is effective without extinction, even when stimuli with varying levels of preference are presented. However, response suppression was not predicted by preference ranking in the paired-choice method or duration of engagement

in competing stimulus assessments. Although the focus of this study was not to evaluate more efficient, practical methods to identify potent reinforcers for treating aberrant behaviors exhibited by children, these findings question the utility of conducting preference assessments and functional analyses for tangibly maintained behaviors. Functional analysis and preference assessments are time-consuming and require training prior to implementation. These procedures took several weeks to be completed before NCR was initiated. Given that parental report accurately identified preferred items and presumed functional reinforcers used in NCR conditions for both subjects, similar results may have been obtained if the functional analysis and preference assessments were omitted. Although several studies demonstrate the unreliability of results obtained from questionnaires and behavior checklists (e.g., Sigafos, Kerr, Roberts, Couzens, 1993; Zarcone, Rodgers, Iwata, Rourke, & Dorsey, 1991), this was not the case in the present investigation. When taking into consideration the growing ethical concerns for least restrictive environments, empirically supported treatments, and the promotion of personal welfare in the treatment of behavior problems (Van Houten, 1988), especially when individuals require immediate treatment (Paclawskyj, Kurtz, & O'Connor, 2004), further research is critical for developing more predictive and accurate behavioral assessment procedures to identify effective reinforcers.

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APPENDICES

Appendix A: Human Subjects Review Committee Approval Letter

**EASTERN MICHIGAN UNIVERSITY  
PSYCHOLOGY DEPARTMENT  
HUMAN SUBJECTS RESEARCH COMMITTEE**

June 28, 2007

Dear Tamara,

The Psychology Department Human Subjects Research Committee (HSRC) has reviewed your revised study, "The Relative Contributions of Preference and Functionality in Noncontingent Reinforcement Schedules." I, too, have read the study. Both reviewers recommended approval of the study, and based on my own reading, I agree. Best wishes on your study. It looks interesting, and I hope it goes well for you.

Most sincerely,

Steven K. Huprich

Steven K. Huprich, PhD  
Chair, Human Subjects Research Committee  
Department of Psychology

cc: Marilyn Bonem, PhD

Appendix B: 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)

## Appendix C: Informed Consent

Your child has been identified as potentially benefiting from participation in our research project using reward-based procedures to reduce problem behavior. Please consider the following.

1. **Purpose of the Study and How Long it Will Last:** The purpose is to compare a variety of reward-based interventions to decrease behavior that may interfere with peer relationships, school achievement, and social goals. Your child would participate in a screening process. If selected, your child would participate in an ongoing intervention, with daily treatment sessions, lasting up to an hour and a half spread out during the day. This study is expected to last for 8-10 weeks.
2. **Participation Withdrawal or Refusal to Participate:** Your child's participation in this study is voluntary. If your child is able to understand verbal explanation, please take a few minutes to explain the study and have your child sign below. A simple explanation might refer to his or her misbehavior and ask if it is okay to use rewards to work on getting it to occur less. You or your child can choose not to participate or may quit at any time without penalty of any sort. Before the study begins, the researchers will explain the study to the child, confirming a desire to participate. Participation in this intervention is not the only means of addressing your child's behavior problems, in that this is a goal typically addressed within educational and recreational programs or through private outpatient therapy.
3. **Description of the Study Including Procedures to Be Used:** You or your child's teacher or program staff who work with your child may be asked to complete brief questionnaires. In addition, your child may participate in assessment and treatment procedures designed to effectively reduce targeted behaviors. Specifically, the intervention will involve repeated presentation of toys and edible items that your child likes. Typically, children express enjoyment of such activities. All food items will be prepackaged (i.e. not homemade) and you will have the chance to approve all items.
4. **Description of Any Procedures that May Result in Discomfort or Inconvenience:** Procedures are unlikely to produce discomfort. However, while some children may find the activities more interesting than their usual routine, others may become bored, feel they are missing regular classroom activities, or be embarrassed to leave class. To avoid these issues, treatment and assessment sessions will be scheduled around important activities. In addition, each day, your child will be approached individually and discreetly given the option to participate or not, as desired.

Your child may be videotaped during the study for data analysis and potentially for future training of psychology students in observational and reward-based techniques. All videotapes will be stored indefinitely in a locked cabinet and no identifying information will be listed on the outside of the tape. However, you may elect to allow participation, but not allow videotaping and/or storing of the tapes after the study is completed.

5. **Expected Risks of the Study:** There are no known risks for participating in the current study. Although all procedures are reward-based, in the unlikely event that your child's behaviors seem to worsen because of any procedures, the study will be discontinued immediately. In addition, if any risks of these procedures are revealed in the research literature during the course of the study, you will be informed immediately.



- 6. Expected Benefits of the Study:** Your child may benefit from some of the interventions to help reduce problem behavior, but may benefit more from some than others. You or staff interacting with your child will also obtain information about factors that are causing this behavior to occur. In addition, participating in this study will help increase our understanding of how to develop successful interventions for schoolchildren.
  
- 7. Use of Research Results:** Because this study will be conducted at your child's school or other program, staff interacting with your child will be aware of your child's participation. If desired, results concerning the cause of your child's behavior problems and interventions that may reduce it will be shared at the end of the study with parents and staff. These research results may be presented at research meetings or conferences or published in professional journals. However, your child's name will not be used so that he or she cannot be identified. Videotaped clips will be viewed by researchers and may be shown for training and demonstration purposes only as specified above. All paperwork and videotapes will remain private and stored in a private, locked location at Eastern Michigan University.
  
- 8. If you have any questions about your child's participation in this study now or in the future, you can contact Tamara Pawich ([tpawich@emich.edu](mailto:tpawich@emich.edu)), Dr. Marilyn Bonem ([mbonem@emich.edu](mailto:mbonem@emich.edu)), or Chair of Psychology Department Human Subjects Review Committee, Dr. Steven Huprich ([shuprich@emich.edu](mailto:shuprich@emich.edu)) at (734) 487-1155, in the Department of Psychology at Eastern Michigan University.**

If you have read and understood the above and will allow your child to participate, please provide your name, date, and signature below. By doing so, you are giving informed and voluntary consent.

Please check the following:

- Participate in study**
- Allow videotaping for data analysis only (to be destroyed thereafter)**
- Allow videotapes to be used for future training**

\_\_\_\_\_  
Your Child's Name

\_\_\_\_\_  
Your Child's Signature (if possible)

\_\_\_\_\_  
Parent's Name (Print)

\_\_\_\_\_  
Parent's Signature/Date

\_\_\_\_\_  
Signature of Staff Member/Date

\_\_\_\_\_  
Signature of Witness or Research Assistant/Date

\_\_\_\_\_  
Signature of Principal Investigator/Date

Appendix D: Data Sheet for Functional analysis, Arbitrary Reinforcement Tests, and NCR conditions

Participant #: \_\_\_\_\_ Date: \_\_\_\_\_ Observer: \_\_\_\_\_ Phase: \_\_\_\_\_

Please indicate the session number and condition in the respective boxes. Write a tally in the behavior boxes to indicate each time the target behaviors occur. If no behavior occurs, write a zero in the box.

Session #	Condition	Behavior 1:	Behavior 2:	Behavior 3:



Appendix F: Competing Stimulus Assessment Data Sheet

Participant #: \_\_\_\_\_ Observers: \_\_\_\_\_ Date: \_\_\_\_\_

Mark an E in each interval box that the participant engages with the item regardless of appropriateness of play. Mark a T in each interval box if a tantrum occurs. All intervals are 15 seconds in duration and sessions are 10 minutes.

**Item:** \_\_\_\_\_ **Preference Ranking:** \_\_\_\_\_

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20

% Engagement= \_\_\_\_\_ % Tantrum= \_\_\_\_\_

**Item:** \_\_\_\_\_ **Preference Ranking:** \_\_\_\_\_

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20

% Engagement= \_\_\_\_\_ % Tantrum= \_\_\_\_\_