A COMPARISON OF PROCEDURES FOR UNPAIRING CONDITIONED
REFLEXIVE ESTABLISHING OPERATIONS

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ABSTRACT

The purposes of the current investigation were to a) pair a neutral stimulus with aversive demands to determine if the stimulus could be conditioned to evoke communication responses as a conditioned reflexive establishing operations (CEO-R) and b) systematically determine the relative effects of two unpairing procedures on the communication evoked by the CEO. Task demands were shown to be establishing operations, evoking problem behavior to access escape, for 4 students with disabilities. Alternative communication responses were taught as an appropriate method to request escape. This treatment combined with extinction for problem behavior led to decreases in problem behavior for all students. A stimulus was then paired with the task demand during the motivating operations analysis to create a reflexive conditioned establishing operation (CEO-R) that evoked communication responses. Once data suggested that the stimulus was functioning as a CEO-R, two methods were evaluated to reduce the value of the stimulus. Results indicated that noncontingent reinforcement unpairing was an effective method to reduce the evocative effects of the stimulus. Extinction unpairing also decreased the value of the stimulus, but the evocative effects were never completely abolished. Results are discussed in terms of abolishing CEOs and the applied implications of CEOs.
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CHAPTER 1

INTRODUCTION

The topic of motivation has received renewed interest in the field of applied behavior analysis. This interest can be attributed in part to the conceptual framework set forth by Michael (1982; 1993; 2000). According to this framework, a motivating operation (MO) is defined as an antecedent stimulus or event that alters the momentary value of a consequence (value-altering effect) and that simultaneously evokes or abates behavior that has previously led to that consequence (behavior-altering effect; Laraway, Snyderski, Michael, & Poling, 2003; Michael, 2000).

Within the general category of MOs, there are two distinct classifications of stimuli with opposite behavioral effects. Establishing operations (EOs) are stimuli that increase the value of a consequence and increase behaviors that have been followed by that consequence. Abolishing operations (AOs) are stimuli that decrease the value of a consequence and decrease the frequency of behaviors that have been followed by that consequence. A specific MO having these two behavioral effects (value-altering and behavior-altering) often occurs along a continuum, functioning as an EO at one end and as an AO at the other. Consider, for example, two of the most discussed examples of
MOs, food deprivation and satiation. At one end of the continuum is food deprivation (EO), which increases the value of food as a reinforcer and increases in frequency any response that has been reinforced with food. Consumption of food then decreases food deprivation and at the opposite end of the continuum is food satiation (AO). The same two behavioral effects will occur with this stimulus change (value-altering and behavior-altering), although the effect will occur in the opposite direction. Thus, food satiation will decrease the value of food as a reinforcer and decrease in frequency any response that has been reinforced with food in the past.

Although most previous discussions of MOs have portrayed MOs primarily as establishing stimuli, increasing the value of consequences, these variables also occur in the opposite direction (Laraway et al., 2003; Michael, 2000). Additionally, although the examples above fit well and seem to demonstrate the categories of MOs that have been set forth by Michael (1993; 2000; 2007), there is a lack of empirical research demonstrating these and other characteristics of MOs.

Characteristics of Motivating Operations

One of the defining characteristics of an MO is that every stimulus or event functioning as an MO will meet two criteria (Michael, 2000). First, the MO will alter the value of a consequence (value-altering effect), in either a positive (EO) or negative (AO) direction. Second, the MO will evoke (EO) or abate (AO) behaviors that have previously led to that consequence. It has recently been proposed that the MO may have an additional (third) effect on other antecedent stimuli (Laraway et al., 2003). Specifically,
the MO may change the evocative effects of a discriminative stimulus (S^d), for example, by increasing or decreasing the effectiveness of the S^d.

Conceptual discussions of MOs have allowed researchers to distinguish between these and other antecedent variables. It is not surprising that motivational variables were at first confounded with other antecedent variables, including S^d's because of the similarities between these two types of stimuli. The difference between S^d's and MOs is an important distinction, however, that has been discussed in detail by Michael (1982; 1993; 2000; 2007) and others (Laraway et al., 2003; McGill, 1999). An S^d acquires stimulus control over a response through its relation with an effective form of reinforcement; it evokes behaviors that have previously led to that reinforcer in its presence. This relation with a reinforcer must be one in which the S^d signals that the effective reinforcer is available (Cooper, Heron, & Heward, 2007). For a stimulus to function as an S^d, however, there must also be a stimulus condition that signals when the reinforcer is not available (often the absence of the S^d). In the presence of this stimulus (the S delta), the reinforcer would be an effective form of reinforcement if it were available. Although MOs and S^d's both precede and change the current frequency of a behavior, only MOs have value-altering and behavior-altering function. Therefore, an S^d is an antecedent stimulus or event that signals the availability of a reinforcer, thus evoking responses that have led to that reinforcer in the past. An MO, on the other hand, is related to the value of the reinforcer, rather than its availability. This distinction is important so that variables that alter behavior can be properly identified and empirically studied.
Every MO has the possibility of having multiple effects on multiple behaviors. It is also likely that every behavior is under the influence of more than one MO at any given time. These concepts of multiple effects and multiple control have been observed and described in previous papers (e.g., Laraway et al., 2003) and is evident in published research involving behavior change, which will be discussed later.

Finally, the MO *momentarily* alters the value of a consequence and changes the frequency of responses that have led to that consequence. For example, food consumption will only momentarily alter the value of food. Once time passes, the value of food will return. Therefore, a final defining characteristic of the MO is that the effects of the MO are temporary. This distinction has also been observed in previous research involving behavior change, as will be discussed later.

There has been a dramatic increase in research on motivation in behavior analysis (Iwata, Smith, & Michael, 2000). Nevertheless, the current theoretical framework for motivation as a subject matter has developed in advance of the available empirical support. Therefore, it is important to analyze previous research from an MO perspective. Several researchers have discussed existing research in terms of motivation (McGill, 1999; Wilder & Carr, 1998). These papers, however, are somewhat dated given the increasing literature on MOs. Additionally, the McGill and Wilder & Carr papers were written before Michael (2000, 2007) and others articulated the distinction between EOs and AOs. Many of the characteristics of MOs, however, can be observed either directly or indirectly in earlier behavior change research. Specifically many studies provide
support for the operation of MOs although the results have infrequently been discussed in terms of motivation.

Results of Literature Review

Analysis of existing literature provides indirect support for many of the characteristics of MOs that have been described but not clearly illustrated empirically. For example, several studies indirectly verify that (a) the value-altering and behavior-altering effects of an MO are separate effects that can be observed independent of one another under the correct conditions, (b) MOs may have multiple and simultaneous effects on different responses or multiple responses can be effected by the same MO, and (c) MOs create momentary, as opposed to permanent changes in the reinforcing value of stimuli.

O’Reilly, Sigafoos, Edrisinha, Lancioni, Cannella, and Choi (2006) demonstrated the evocative function of the EO by evaluating deprivation of a reinforcer when the behavior did not produce access to the reinforcer during the experimental session. McAdam and colleagues (2005) reported results that would suggest the value-altering effect without the evocative effect. In their analysis, satiation and deprivation led to changes in degree of preference for tangible items, suggesting that the value of the reinforcers was reduced and increased, respectively. Consistent with Michael’s (2000; 2007) theoretical discussions on the effects of MOs, the results of these two studies provide preliminary evidence that the two effects produced by MOs are separate phenomena that can be observed independent of one another.
In addition, several studies also demonstrate that one or more MOs can simultaneously affect multiple behaviors and that more than one MO can simultaneously affect the same behavior. For example, results of a study by Derby, Fisher, and Piazza (1996) suggested that a noncontingent attention (NCA) procedure created an AO for both self-injurious behavior (SIB) and self-restraint and that providing attention contingent on SIB also created an AO for self-restraint. These data illustrate how the same environmental variable can simultaneously affect multiple responses.

Similarly, the results of Goh, Iwata, and DeLeon (2000) suggested that a noncontingent reinforcement (NCR) treatment decreased the value of attention and a tangible item for two participants, respectively, and decreased both appropriate and inappropriate responses that were reinforced by these stimuli. This illustrates how one stimulus change, the availability of NCR, simultaneously affected motivation to engage in two responses.

Additionally, one stimulus change can also have opposite effects on two different responses. For example, Burzek and Thompson (2007) demonstrated that an AO for engagement with one stimulus and an EO for engagement with another stimulus was created when preschool children observed a peer play with one of the stimuli. Therefore, one stimulus event (i.e., observation of peer play) functioned as an EO and AO for different stimuli.

Finally, one of the defining characteristics of MOs is that manipulations result in momentary and thus temporary changes in the reinforcing effectiveness of stimuli. After an EO is reduced or removed, the EO may return and motivation to engage in the
response that was decreased may also return. Results of extended applications of NCR with an arbitrary stimulus (Lindberg, Iwata, Roscoe, Worsdell, & Hanley, 2003), for example, demonstrated that once the EO for a response returns, the behavior may increase.

Much of the literature presented demonstrating the characteristics and effects of MOs occurred before the increased attention and interest in motivation in behavior analysis. Therefore, in much of the research presented, the authors did not discuss the role of MOs in their findings. Additionally, very few of the studies have sought to identify the behavioral mechanisms involved in the reduction of behavior. Thus, the MOs have not always been evaluated independent of other behavior change mechanisms.

Conditioned Motivating Operations

As discussed above, MOs can alter the value of a consequence in either an increasing (EO) or decreasing (AO) manner. Another important distinction is whether the MO is a relation that is unlearned or learned. An unconditioned motivating operation (UMO) is a stimulus whose value-altering effects are unlearned. Michael (2007) discusses 9 primary UMOs that alter the value of primary reinforcers for human beings, including deprivation of the primary reinforcers of food, water, sex, activity, oxygen, sleep, as well as temperature changes of becoming too warm or too cold. A conditioned motivating operation (CMO) has value- and behavior-altering effects identical to those of UMOs, but these stimuli have acquired their motivational effects as a result of the learning history of the organism. According to Michael (1993; 2007), there are at least three types of CMOs (i.e., surrogate, transitive, and reflexive), each of which acquires a
motivational effect based on a specific relation to a UMO, another CMO, or a consequence.

The first type of CMO is a previously neutral stimulus that has been paired with, or systematically precedes, a UEO or another CMO, and thus acquires the same value and behavior-altering effects as the MO with which it was related. This relation between the CMO and the putative MO is a simple temporal relation, and Michael (1993; 2007) provided the label of a surrogate CMO (CMO-S) for this type of variable. An example of a CMO-S would be demonstrated if a location or color is paired with a state of satiation or deprivation of food. If this location or color subsequently alters the value of food as a reinforcer and evokes (CEO-S) or abates (CAO-S) behaviors that have been reinforced with food in the past, then the event would appropriately be labeled a CMO-S.

A second type of CMO is the transitive CMO (CMO-T), which establishes another event as an effective consequence, instead of itself. This type of CMO acquires its motivational effects through a relation with another variable that alters the value of a consequence (Michael, 1993; 2007). An example of this type of CMO can be observed in a simple behavior chain. The first response in a chain produces a stimulus change that functions as a conditioned reinforcer for that response, and as an $S_d$ to evoke the second response in the chain. If the reinforcer for response one, for example, is a tone and the reinforcer for the terminal response is food, then food deprivation functions as a CEO-T altering the value of the tone as a conditioned reinforcer for response one and evoking the response that produces this conditioned reinforcer.
Finally, a third type of CMO becomes conditioned through pairing of the variable with some form of environmental worsening or improvement, and has been labeled as a reflexive CMO (CMO-R). This type of MO acquires its motivating effects by preceding the environmental improvement or worsening, and thus establishing its own removal as an effective form of reinforcement or punishment and evokes responses that have previously been reinforced by the removal of this event. For example, if a warning stimulus is frequently paired with the delivery of a shock (a worsening environment), then removal of the warning stimulus as a reinforcer will increase in value and responses that have previously led to removal of the stimulus will increase in frequency.

Reflexive Establishing Operations

Basic research on stimuli that precede aversive events, such as shock, may lend some empirical support for reflexive CEO. For example, in a procedure often referred to as Sidman Avoidance (Sidman, 1955), shocks are presented on a fixed-time schedule. Responses in the interval preceding the shock will delay the onset of the shock, and maintaining a minimum rate of responding will avoid all shocks. Subjects will quickly produce response rates necessary to avoid shocks. In similar, but discriminated, avoidance procedures, shocks continue to be presented on a fixed-time schedule, but each shock is preceded by a stimulus (e.g., a tone). When responses (e.g., lever presses) in the presence of the stimulus are reinforced by removal of the stimulus and avoidance of the upcoming shock, the stimulus begins to evoke these responses. These data are typically presented as the percentage of stimuli discriminated (Sidman, 1955). The warning stimulus, however, is probably better described as an EO for several reasons. First, the
shock is a UEO that temporarily increases the value of shock removal as a negative reinforcer for responding. There is not a situation in which shock removal would be an effective reinforcer, but is unavailable (i.e., there is not an S delta) and therefore the shock cannot be functioning as an S\text{d}. Second, the warning stimulus is paired with, and acquires value from the UEO. In the example of the warning stimulus, this stimulus is paired with a worsening environment—the upcoming shock. Michael (2000; 2003) describes a stimulus that functions in this way as a reflexive CEO. It is a conditioned stimulus because the stimulus did not have value or evoke responding before its relation with the shock. It is reflexive because the stimulus signals the worsening of the environment—the upcoming shock—and establishes its own removal as a reinforcer.

It may be important to describe why this stimulus does not meet the criteria of a S\text{d}. In order for a stimulus to be functioning as an Sd, a reinforcer must be available in its presence and unavailable in its absence. Two potential reinforcers that may maintain responses in the presence of the warning stimulus are (a) escape from the stimulus, and (b) avoidance of the shock. There is never a situation in which the potential reinforcer—escape from the stimulus—would be an effective reinforcer but is unavailable (Michael, 2000). The second potential reinforcer, avoidance of the shock, is also available for a response during the interval preceding the stimulus and thus the reinforcer is no more likely in the presence of the stimulus than in its absence. Therefore, neither of the potential reinforcers maintaining the response in the presence of the warning stimulus is signaled by the presence of the warning stimulus, so it does not meet the criteria for an .
Abolishing the Value of a Reflexive CMO

Abolishing the value of a CMO-R can occur in several ways according to Michael (2000). First, responses evoked by the CEO-R can be placed on extinction. Extinction would consist of altering the contingency between the response in the presence of the CEO and the reinforcer for that response. In the case of the warning stimulus above, the response would no longer result in the removal of the warning stimulus and the shock would continue to be presented on the original fixed-time (FT) schedule. In addition to operant extinction, behavior evoked by the CEO can be decreased by weakening or removing the CEO from the environment. For example, the warning stimulus can be removed from the environment or the properties of the stimulus may be altered. This procedure, however, will only temporarily decrease the frequency of the responses.

Michael (2000) has proposed that two methods of unpairing should also reduce the value of, and decrease responses evoked by, the CEO-R. Both methods result in an unpairing of the relation between the CEO-R and the UEO or CEO with which it acquired its value. In the first method, the CEO-R is presented and responses still lead to reinforcement in the form of escape from the CEO-R, but the CEO-R is no longer followed by the putative UEO (or CEO). For example, the warning stimulus in the avoidance procedure described above would be presented and responses in the presence of the stimulus would continue to be reinforced with escape from the warning stimulus. The shock, however, would no longer follow the warning stimulus regardless of whether a response was emitted in the presence of the CEO-R. This should result in the presence of the CEO-R becoming no more aversive than the absence of the CEO-R, and thus
render the removal of the CEO-R less valuable (Michael, 2000). Essentially, this method would result in noncontingent (because the UEO isn’t presented whether or not escape responses to the CEO is emitted) avoidance of the UEO (or CEO). Because of this relation, this procedure will be referred to as NCR unpairing. In a second method of unpairing, the CEO-R is presented and responses continue to produce reinforcement in the form of escape from the CEO-R, but the UEO (or CEO) continues to be presented following the CEO-R, regardless of responding. For example, the warning stimulus in the avoidance procedure described above would continue to be presented and responses in the presence of the stimulus would continue to be negatively reinforced with escape from the warning stimulus. The shock, however, would continue to be presented regardless of responding in the presence of the warning stimulus. Specifically, the UEO is now just as likely to occur in the presence and absence of the CEO-R, and thus the presence of the CEO-R should become no more aversive than the absence of the CEO-R. Essentially, this procedure results in extinction of the avoidance reinforcer, and thus this procedure will be referred to as extinction unpairing.

Little is known about the way these procedures impact CEOs because very little empirical research has investigated CEOs in a systematic way. Although MOs can be conditioned in a person’s environment and display the same behavioral effects as all other MOs (i.e., value- and behavior- altering effects), information is typically not known about the environmental stimuli that evoke behavior as CEOs to verify Michael’s predictions. CMOs have acquired their effects through relations with other MOs (UMOs or CMOs) and conditioned and unconditioned reinforcers. Often the individual learning
and reinforcement history of a participant is unknown, making it difficult to evaluate a specific CMO and determine how that CMO acquired its properties. Therefore, the impact of AOs on these stimuli is also unknown.

Basic research involving extinction of the avoidance response in discriminated avoidance does provide empirical support for abolishing the value (as an AO) of the warning stimulus to decrease responses that are evoked by the CEO. In fact, the NCR unpairing procedure described by Michael (2000) has essentially been empirically demonstrated in studies that have examined extinction of the avoidance response (although this procedure does not actually qualify as an extinction procedure, per se). Sidman (1955), for example, trained rats and cats in an undiscriminated avoidance procedure. Once stable responding was observed, a warning stimulus (CEO) was introduced. When the stimulus consistently evoked responses, a condition was introduced in which the response continued to avoid the warning stimulus, but the warning was no longer followed by the shock. This procedure was described as extinction, although the procedure does not fit well with a description of extinction. Responses continued to produce reinforcement in the form of removal of the warning and the shock was removed noncontingently. During this noncontingent unpairing of the stimulus and the shock, responses in the presence of the shock decreased to levels lower than those observed during training. This unpairing phase, however, lasted only 15 min, which was not long enough to observe complete response suppression.

During a subsequent analysis a similar procedure was used to decrease avoidance responses that were maintained with a warning stimulus, a short response-shock (R-S)
interval without a warning stimulus, and longer R-S intervals without a warning stimulus (Schnidman, 1968). Results indicated that responding decreased during unpairing following each type of training condition (i.e., training without a warning and shorter R-S intervals, training without a warning and longer R-S intervals, and training with a warning stimulus), although responding was suppressed more quickly when responses were maintained in the absence of the warning stimulus. That is, the warning stimulus decreased the rate of response suppression. Results also indicated that responding during unpairing was related to the strength of the response during avoidance conditioning.

The arrangement described above for the warning stimulus may provide a model for a way to study the CEO-R in an applied setting. If a stimulus were paired with an aversive event and became conditioned to evoke responses reinforced by its own removal, then a CEO would be created. Creating this stimulus to function as a CEO would also allow the history of the stimulus to be known. AOs to reduce the value of the stimulus could then be empirically evaluated. In the current investigation, similar procedures were used to create a CEO through pairing. Subsequently, the effects of unpairing on these stimuli were systematically evaluated.

Purpose

The first purpose of the current investigation was to pair a neutral stimulus with aversive demands to determine if the stimulus could be conditioned to evoke communication responses as a CEO. The second purpose of investigation was to systematically determine the relative effects of two unpairing procedures on behavior evoked by the CEO. During pairing, the CEO was presented for 10 s immediately
preceding the onset of the demand (EO). Responses in the presence of the CEO resulted in termination of the CEO and avoidance of the demand. Following demonstration that the neutral stimulus had acquired value as a CEO (as shown by responding occurring in the presence of the CEO), two unpairing methods were evaluated to reduce the value of, and the frequency of responses evoked by, the CEO. During both methods, the responses continued to be reinforced by the removal of the CEO, but the relation between the CEO and EO was unpaired. In the NCR unpairing, the CEO was presented but was no longer followed by the EO. In the extinction unpairing, the CEO was presented and followed by the EO regardless of responding in the presence of the CEO.
CHAPTER 2

LITERATURE REVIEW

Motivating Operations

There has been a dramatic increase in research on motivation in behavior analysis (Iwata et al., 2000). Nevertheless, the current conceptual framework for motivation as a subject matter has developed in advance of the available empirical support. Therefore, it is important to analyze previous research from an MO perspective. To date, several researchers have attempted to discuss existing research in terms of motivation (McGill, 1999; Wilder & Carr, 1998). These papers, however, are somewhat dated given the increasing literature on MOs. Additionally, both of these papers were written before the distinction between EOs and AOs was articulated, and thus focused on the establishing effects of motivation with less discussion of the abolishing effects. Many of the characteristics of MOs, however, can be observed either directly or indirectly in earlier behavior change research. Specifically many studies provide support for the operation of MOs although the results have infrequently been discussed in terms of motivation. The purpose of the current literature review is to discuss the role of AOs in decreasing behavior. This discussion will also include analyses of existing research as evidence for
AOs and implications of the findings for changing behavior and for future study of motivational variables.

Analysis of AOs in Existing Literature

All AOs will have the same two effects on stimuli and behaviors (i.e., change the value of reinforcers and punishers and increase or decrease behaviors related to these consequences). Specific mechanisms and processes by which these AOs affect behavior, however, often vary. For example, the process through which an AO can affect positive, negative, and conditioned reinforcers can be different. The discussion of AOs in the literature, therefore, will be organized by a hypothesized process. It is also important to note that almost all research that involves the reduction of at least one response can likely be discussed in terms of motivation on some level. The current paper, however, will focus on antecedent manipulations that suggest a very clear role of the MO either directly or indirectly through the control of other variables. Additionally, an attempt to discuss phenomena that fit better with an alternative explanation will not be discussed in terms of MO research. For example, literature on matching, variability, and dimensions of reinforcement are omitted from the current discussion, even though it is likely that motivation plays a role in those behavioral phenomena as well.

Procedures that Create an AO by Providing Additional Sources of Reinforcement

AOs decrease a response by reducing the value of a putative reinforcer. There are many ways in which this may be accomplished. For example, procedures may provide an additional source of the specific consequence maintaining a response, and thus decrease
the value of that consequence as a reinforcer. This will result in a decrease in frequency of any response that has led to that consequence in the past.

NCR and providing presession access to a reinforcer, for example, are both procedures that have been shown to reduce the effectiveness of the reinforcer for a specific behavior. NCR was initially used as a control procedure to compare the effects of reductive behavior procedures in the reinforcement literature (Kahng, Iwata, Thompson, & Hanley, 2000). More recently, however, NCR has also become a frequently used treatment for problem behavior.

NCR involves the delivery of a reinforcer on a response-independent schedule and can thus decrease motivation to engage in responses to access that reinforcer. Carr, Kellum, and Chong (2001) evaluated the effects of noncontingent food delivery on FT and variable-time (VT) schedules for arbitrary responses maintained on variable-ratio (VR) schedules of contingent reinforcement. Results indicated that noncontingent food delivery reduced responding for both participants (to near zero levels for one, and to 50% of the contingent reinforcement condition level for the other). Similarly, Carr, Bailey, Ecott, Lucker, and Weil (1998) evaluated the effects of noncontingent delivery of different magnitudes of reinforcement for appropriate behavior maintained on a VR 3 schedule of reinforcement for five adults diagnosed with severe to profound mental retardation. Results indicated that high, stable rates of block sorting were observed during baseline when a VR 3 schedule of reinforcement was in place for sorting. During the NCR conditions when a low magnitude of reinforcement was delivered on an FT schedule, rates of sorting slightly lower than baseline were observed for two of the five
participants, while the remaining three participants continued to engage in rates of responding similar to those observed during baseline. When a medium magnitude of reinforcement was delivered on the same FT schedule, responding was clearly lower than baseline levels for four of the five participants. Finally, when a large magnitude of reinforcement was delivered, significantly lower rates of responding were observed immediately for all three of the participants exposed to that condition. Although extinction was in place for responding, an explicit test for the abolishing effect of NCR was accomplished by altering the magnitudes of reinforcement delivery during the NCR schedules, thus holding the consequence variable constant. Results indicated that larger magnitudes of response independent food delivery functioned as an AO for appropriate responses maintained by food reinforcement.

In an extension of this work, Roscoe, Iwata, and Rand (2003) delivered differing magnitudes of reinforcers contingent on appropriate responses and on a noncontingent schedule. In experiment 1, the authors found that a medium magnitude of food reinforcement increased consumption time, which led to decreases in overall response rates for appropriate behavior, but did not decrease the response rates when the consumption time was included in the calculations. In Experiment 2, however, the authors empirically determined the values of small, medium, and large magnitude reinforcers. They then evaluated these different magnitudes of reinforcement on response rates in contingent and noncontingent schedules, while correcting for consumption time. Additionally, they evaluated the medium magnitude reinforcer in both brief (10 min) and extended (30 min) applications. Decreased response rates for two participants indicated
that both larger magnitudes and longer durations of reinforcement with medium
magnitude reinforcers, both created an AO for the appropriate response. A final note on
the results of this experiment is that during the reinforcer probes, decreases in response
rates with a medium magnitude reinforcer were observed when the reinforcers were
delivered on a continuous schedule, suggesting that this AO affected responding during a
contingent schedule as well.

The three analyses cited above all superimposed a noncontingent schedule of
reinforcement on a contingent schedule of reinforcement with the same stimulus.
Although these provide clear evidence of the role of AOs in decreasing appropriate
responses, it is also possible that this may occur without being directly programmed. For
example, noncontingent delivery of a reinforcer to reduce one response can also decrease
an appropriate response that is maintained by the same reinforcer. In fact, this effect has
been reported in analyses targeting the reduction of problem behavior (Goh et al., 2000;
Moe & Vollmer, 1996).

As a treatment for problem behavior, NCR also involves the delivery of a
reinforcer on a response-independent schedule. This procedure is often combined with
operant extinction, thus interrupting the contingency between the problem behavior and
its putative reinforcer. Because the procedure often involves both antecedent and
consequent manipulations, the behavioral mechanisms underlying NCR during the
treatment of problem behavior were initially unclear. For example, in one of the first
experimental demonstrations showing the effectiveness of NCR as a treatment, Vollmer,
Iwata, Zarcone, Smith, and Mazaleski (1993) compared NCA combined with extinction
to a differential reinforcement procedure. Results indicated that both treatments were similarly effective at reducing problem behavior maintained by attention for three participants. The authors also found that the cumulative number of SIB responses and beginning of session extinction bursts were minimized in the NCR condition. The behavior mechanisms responsible for the decreases in responding and the attenuation of bursting were unclear, because the treatment consisted of both the antecedent manipulation of noncontingent delivery of attention and the interruption of the contingency between SIB and reinforcement in operant extinction. The possible role of the AO, however, is indirectly suggested by the lower levels of problem behavior and the reduction of bursting in the condition that included an NCR component. Many other researchers have evaluated the use of noncontingent delivery of the functional reinforcer for problem behavior maintained by positive reinforcement in the form of access to either tangible items (Lalli, Casey, & Kates, 1997; Goh et al., 2000) or to social attention (Vollmer et al., 1998; Goh et al.), and negative reinforcement in the form of escape from task demands (Vollmer, Moe, & Ringhahl, 1995).

Additional analyses have sought to clarify the role of the AO and extinction within NCR procedures, and several have been successful in demonstrating the role of the abolishing effects of NCR schedules. For example, Vollmer et al. (1998) compared the effects of NCR combined with extinction and extinction alone on the socially maintained problem behavior of three individuals with mental retardation. Although both treatments contained an extinction component and were effective in reducing problem behavior, lower rates were observed in the NCR with extinction treatment for all three participants.
Additionally, extinction bursts were observed for all three participants in the extinction only condition, while the NCR condition attenuated such bursting. Although the NCR treatment consisted of two components, the effects of the AO were suggested in two ways. First, because the FT delivery of the functional reinforcer was the only difference between the two conditions, the attenuation of extinction bursts in the NCR condition suggested that the AO was responsible for the decreased levels of responding. Second, the extinction contingency was not contacted in the NCR condition for any participant until the delivery of reinforcement had been faded to a relatively lean schedule. This showed the AO effect of the FT delivery for attention and escape as reinforcers for problem behavior.

Lalli et al. (1997) evaluated the effects of noncontingent delivery of the functional reinforcer for problem behavior maintained by access to tangible items. The NCR program consisted of an FT schedule of reinforcement and was evaluated in the absence of extinction for one of the three participants. The data for the participant exposed to NCR without extinction suggested that the noncontingent delivery of a functional reinforcer could create an AO for the preferred tangible item and decrease problem behavior maintained by access to that item.

Similarly, Hanley, Piazza, and Fisher (1997) conducted a functional analysis and found that the problem behavior of two participants was maintained by access to attention. In the treatment analysis, the authors found that NCA (functional reinforcer) on a continuous schedule decreased problem behavior. Although extinction was a component in this analysis, one participant never contacted the extinction contingency. Therefore,
results for this participant suggested that the noncontingent delivery of the functional reinforcer created an AO for problem behavior.

In a final example of NCR as a treatment for problem behavior, Vollmer and colleagues (1995) evaluated a noncontingent escape (NCE) treatment for two participants who engaged in problem behavior maintained by escape from demands. Although the NCE treatment contained an extinction component, neither of the participants contacted the contingency during the initially dense schedule of NCE, suggesting an AO for problem behavior. As the schedule of NCE was thinned, however, both participants contacted the extinction contingencies. The relative effects of the AO and extinction components, therefore, were unclear.

Another procedure that provides an additional source of reinforcement, which may thereby decrease motivation to engage in a response maintained by that reinforcer, can be observed in the literature on presession contingencies. This research suggests that providing noncontingent access to a reinforcer can create an AO for the reinforcer during subsequent sessions. Berg and colleagues (2000) completed a series of three experiments that assessed the effects of presession conditions on responding in subsequent conditions. In the first experiment, contingent attention functional analysis conditions were systematically evaluated following play and escape conditions. Results suggested that presession attention provided in the play condition abolished attention as a reinforcer in the subsequent contingent attention condition. In the second analysis, they compared play, noncontingent attention, and alone conditions as presession arrangements for an extinction condition. Results indicated that the presession attention provided in the play
condition functioned as an AO for problem behavior maintained by attention as problem
behavior was observed at lower levels following conditions of presession attention than
following conditions of no attention. In the third experiment, the authors examined a
child’s choice between playing with her mother without access to preferred items and
playing by herself with access to preferred items. Following baseline with the concurrent
activity options, presession conditions consisting of either 10 min access to attention
without preferred items or 10 min access to preferred items without attention were
alternated in a multielement design. Results suggested that the participant chose to
receive attention from her mother following conditions of solitary play and selected
solitary play with preferred items following conditions of presession noncontingent
access to attention. Therefore, presession access to attention abolished the reinforcing
effectiveness of attention and presession access to preferred items abolished the
reinforcing effectiveness of those preferred items.

Although these studies suggest a clear role of AOs in the reduction of problem
behavior, the specific process by which the AO affected responding may be less clear.
For example, it is often hypothesized that the abolishing effects of NCR and other AO
procedures can be attributed to satiation. It is not possible to determine if the specific AO
involved in reducing problem behavior in the previous studies was a result of satiation
because information on the consumption of reinforcers was not provided. Two studies
have, however, reported the level of manipulation or consumption of reinforcers.

In one of the studies, Lindberg and colleagues (2003) evaluated both brief and
extended applications of NCR on both appropriate and inappropriate behavior. In
Experiment 1, the authors provided noncontingent access to a LP stimulus during baseline and high levels of engagement with that item were observed for all participants. Following baseline, the participants were given noncontingent access to both HP and LP stimuli during brief (10 min) applications. Engagement with LP stimuli was low, while engagement with the HP stimuli was high for all participants. In a subsequent phase, the authors presented the same stimuli (LP and HP) for extended durations of 120 min. Results for one participant indicated that continued access to the HP item reduced the value of the stimulus over time. Specifically, engagement with the HP item decreased throughout the session and engagement with the LP stimulus increased for one of the two participants. In Experiment 2, the authors conducted a similar analysis with NCR as a treatment for automatically maintained problem behavior. Results indicated that the brief (10 min) applications of NCR decreased SIB for all participants. During extended applications, however, the NCR continued to reduce SIB for only one of the three participants. Engagement with the preferred stimulus decreased and SIB increased over the course of the extended applications for the other two participants. Therefore, NCR functioned as an AO for problem behavior for all participants during brief applications and for one of three participants during extended applications. The role of AOs in this research is twofold. First an AO for problem behavior was created with the NCR treatment. Second, an AO for appropriate behavior in the form of engagement with preferred items was created. The reductions in engagement suggested that the AO did create a state of satiation for the preferred stimulus during extended applications in both experiments.
Hagopian, Crockett, Stone, DeLeon, and Boman (2000), however, observed and reported results that are not consistent with a satiation hypothesis. These authors evaluated the role of satiation and extinction in NCR programs by delivering tangible items on an FT schedule of reinforcement in the absence of extinction. Results indicated that NCR was initially effective in reducing problem behavior, but extinction was necessary to maintain low levels of behavior once the schedule of NCR was thinned. The fact that engagement with the stimulus remained high across all sessions, however, indicated that the decreased effectiveness of the treatment procedure was not related to satiation of the reinforcer.

Procedures that Create an AO by Providing Alternative Sources of Reinforcement

The above discussion has been limited to creating an AO by providing access to the reinforcer responsible for maintaining appropriate or inappropriate behavior. NCR also can reduce behavior by providing alternative sources of reinforcement for a response and thus decrease the reinforcing value of the reinforcer maintaining responding. Although the process is similar, it cannot be attributed to satiation, because the reinforcer maintaining the behavior is not the reinforcer that is being presented on the noncontingent schedule.

One example of this type of AO is when the reinforcing stimulus delivered on a noncontingent schedule is different from the functional social reinforcer responsible for maintaining the behavior. Fischer, Iwata, and Mazeleski (1997), for example, demonstrated that noncontingent delivery of arbitrary reinforcers successfully reduced the attention maintained problem behavior of two participants. Similarly, Fisher,
O’Connor, Kurtz, DeLeon, and Gotjen (2000) and Hanley et al. (1997) demonstrated that noncontingent delivery of tangible items also reduced attention maintained problem behavior and was as effective as the NCA. Each of these analyses provided evidence of the role of the AO by continuing to reinforce problem behavior during the NCR conditions. Again, the specific mechanism underlying this abolishing effect cannot be attributed to satiation because the reinforcer maintaining responding was not provided.

Similar examples of this effect can be observed when NCR is provided as a treatment for behavior maintained by unknown (Roane, Fisher, & Sgro, 2001) or automatically derived sources of reinforcement (e.g., DeLeon, Anders, Rodriguez-Catter & Neidert, 2000; Lindberg et al. 2003; Roscoe, Iwata, & Goh, 1998). In each of these examples, a preferred tangible stimulus (not the functional reinforcer) was delivered on a time-based schedule. Extinction was not a programmed contingency because the reinforcer maintaining responding was unknown. Results of these studies indicated that access to an alternative stimulus decreased levels of problem behavior, thus suggesting that the value of the unknown reinforcer maintaining responding was also decreased. Although the process would still be considered an AO, the specific mechanism involved in the AO would be different. For example, Fisher and colleagues (2000) suggested that a substitute AO was created (similar to reinforcer substitutability). Others have suggested that these or similar procedures may eliminate some general state of deprivation, thus decreasing motivation to engage in a response that is evoked by deprivation of the unknown or automatic source of reinforcement (Roscoe et al.).
Satiation of the functional reinforcer in an NCR treatment program for inappropriate behavior is not a concern, because a decrease in the effectiveness of the functional reinforcer would continue to abolish motivation to engage in the inappropriate response. During the delivery of arbitrary reinforcement in a treatment program, however, satiation of the delivered stimulus may decrease the value of the arbitrary stimulus and the MO for the functional reinforcer may return. An example of this can be seen in a study conducted by DeLeon et al. (2000). In this analysis, the authors evaluated the effects of delivering a single set of toys versus rotating between two sets of toys on the problem behavior hypothesized to be maintained by automatic reinforcement for one girl with severe disabilities. Within-session patterns of data suggested that the noncontingent delivery of one stimulus was initially effective in reducing problem behavior. Engagement with the item decreased, and problem behavior increased over the course of the 30 min session. This suggests that an AO for the unknown reinforcer maintaining problem behavior initially suppressed levels of problem behavior. Following continued stimulus delivery, however, the value of the stimulus decreased and an AO for item engagement was created throughout the session. This AO for item engagement was not observed within the rotating set condition, and access to the rotating sets continued to function as an AO for problem behavior.

Just as an AO can be created by providing presession access to a functional reinforcer, some research has also suggested that presession access to a different stimulus can also function as an AO. For example, Simmons, Smith, and Kliethermes (2003) used a multiple schedule to evaluate the immediate and subsequent effects of noncontingent
food delivery on automatically maintained mouthing of an adult female. In the alone component of the multiple schedule, the participant was alone in a room without access to any items. An increasing FT schedule of food delivery was implemented in the second component, followed by a return to the alone component. Results indicated that rates of mouthing were high during the initial alone component. The FT delivery of food in the second component reduced mouthing to near zero levels. Finally, responding during the second alone component was significantly lower than during the first alone component, although not as low as observed during the FT schedule. Results suggested that the noncontingent delivery of food during component 2 abolished the automatically reinforcing effects of mouthing immediately (during the FT component) and subsequently (during the second alone component).

In a second example of this phenomenon, Zhou, Iwata, and Shore (2002) evaluated responding for food reinforcement on a fixed-ratio (FR) 1 schedule before and after lunch. Results indicated that consumption of meals abolished the reinforcing effectiveness of edibles for four of the nine participants but had no effect for the remaining five participants. In this example, the consumption of edible items created an AO for another type of edible item for some of the participants.

The above research suggests that the motivation to engage in a response can be altered by providing access to an alternative stimulus. The AO involved in the reduction of behavior maintained by the food reinforcer can not be attributed to satiation, because the food reinforcer was not provided during the meal. One possibility is that the alternative edible stimuli may have functioned as substitute reinforcers. Thus reduction in
the value of the food reinforcers may be attributed to providing functionally equivalent items. The results of the Simmons and colleagues (2003) study are consistent with this hypothesis. The consumption of edible items may have had reinforcing properties similar to those produced by placement of the hand in the mouth. An alternative explanation is that a general state of deprivation is provided by the delivery of the alternative stimulus. The data presented by Zhou and colleagues (2002) support this latter hypothesis.

_Treatments That Create an AO by Altering or Eliminating the EO_

Behaviors can be maintained by sources of negative reinforcement in the form of escape from an aversive stimulus. In the negative reinforcement contingency, the aversive stimulus is classified as an EO (Michael, 2000). The stimulus does not alter the availability of escape as a reinforcer, but instead increases the value of escape as a reinforcer. Therefore, another way that an AO may produce decreases in the reinforcing value of a stimulus is by altering or eliminating the aversive properties of the EO evoking escape responses. For example, the aversive properties of an EO may be eliminated by reducing the frequency (Smith, Iwata, Goh, and Shore, 1995; Zarcone, Iwata, Smith, Mazeleski, and Lerman, 1994; Zarcone, Iwata, Vollmer, Jagtiani, Smith, and Mazeleski, 1993), difficulty (Smith et al., 1995), or novelty (Smith et al., 1995) of an aversive demand. These or other properties of other aversive stimuli may also be reduced, instead of eliminated (O’Reilly, Lacey, and Lancioni, 2000; Smith et al., 1995). Finally, habituation to the establishing stimulus can occur following repeated exposure to the EO without changing its stimulus properties (e.g., O’Reilly & Carey, 1996; Smith et al., 1995).
Zarcone et al. (1994) evaluated an instructional fading treatment for three participants with escape maintained SIB. During instructional fading, the EOs (demands) were removed and faded in across sessions when low levels of SIB were observed. Initially, SIB continued to produce escape from demands. Extinction for problem behavior was added to the treatment, and fading was suspended if it failed to produce low levels of inappropriate behavior. Results indicated that the instructional fading without extinction created an AO for SIB when the EO (demand) was on a lean schedule. As the rate of EO presentation increased, however, extinction was necessary to maintain reduction in SIB. In another study, Zarcone et al. (1994) implemented a similar stimulus fading treatment with escape extinction and compared this treatment to escape extinction alone. Results indicated that both treatments were effective in reducing SIB, although SIB was lower when instructional fading was a component of the procedure. The fading procedure was the sole difference between the treatments and differential responding between treatments was observed. Therefore, even though extinction for SIB was in place, results indicated that the stimulus fading functioned as an AO, reducing the value of escape and decreasing problem behavior maintained by escape. Similarly, both of these treatments consisted of first eliminating the EO for the problem behavior, and then fading the EO in when problem behavior remained low. Both studies demonstrate that one of the behavior mechanisms involved in the reduction of behavior was an AO, as extinction bursting was lower in the 1993 study and extinction was not initially part of the treatment in the 1994 study.
In a final example of reducing task presentation (and thus altering the EO) to decrease the value of escape as a reinforcer for problem behavior, Smith et al. (1995) analyzed the extent to which various aspects of demands functioned as EOs for escape maintained SIB. Following a functional analysis, session durations and task presentation rates were evaluated as specific EOs. The authors found that longer session durations and high rates of task presentation both functioned as EOs for problem behavior maintained by escape. Treatments that reduced both the duration and frequency of demands resulted in lower rates of problem behavior. These results suggest that altering the EO reduced the value of escape and decreased behavior maintained by escape.

A few studies have also evaluated the extent to which noisy situations may function as EOs, increasing the value of escape from noise as a reinforcer and increasing behaviors that have led to escape in the past. Similar to treatments that decrease the aversiveness of task demands, treatments may also decrease the aversiveness of noise. McCord, Iwata, Galensky, Ellingson, and Thomson (2001) evaluated the extent to which seven participants were sensitive to noise as an EO for problem behavior. Functional analysis results indicated that the problem behaviors of two of the participants were evoked by noise. A treatment consisting of stimulus fading and extinction was used to decrease problem behavior. Initially, the treatment was effective for both participants. Problem behavior began to reemerge with one participant after the noise level was increased and a DRO component was introduced. Results indicated that a combination of the AO (stimulus fading) and extinction was effective in reducing problem behavior. The
relative influence of each component, however, is not clear because a component analysis was not conducted.

It is also possible to identify the specific aversive property of the stimulus that is functioning as the EO. Treatments, then, may decrease motivation to escape the aversive stimulus by altering or removing that aversive property of the EO. One example of removing the aversive properties of the EO was shown in O’Reilly et al. (2000). The authors found that background noises established escape from demands as a reinforcer for problem behavior, while functional analysis conditions in the absence of noise did not evoke problem behavior. When the participant was provided with noncontingent access to earplugs in the noise condition, the reinforcing value of escape was abolished and problem behavior decreased. These results suggest that earplugs provided to the participant reduced motivation to escape the noise and functioned as an AO for problem behavior.

In another analysis of the specific aversive EO involved in a task demand, McComas, Hock, Paone, and El-Roy (2000) conducted functional analyses for three boys with destructive behavior. They found that each student’s behavior was maintained by negative reinforcement in the form of escape from demands. Interviews and direct observations suggested a different hypothesis for each student regarding the specific aspect of the demand, including difficulty, adult selected task sequence, and repeated task sequences that established escape from demands as a reinforcer for problem behavior. Instructional strategies were developed based on these hypotheses and were evaluated in the treatment analysis. Results indicated that the instructional strategies based on the
hypothesized EOs were effective in reducing problem behavior while behavior continued to produce escape. These results suggest that antecedent manipulations to alter features of the demand situation (without complete removal of the EO), functioned as an AO for problem behavior. (It was necessary to add a DRO contingency to maintain treatment effects for one participant, however).

Habituation involves a decrease in the responsiveness to a stimulus after repeated exposure to that stimulus (McSweeney, 2005). For example, after repeated exposure to a demand, the aversiveness of that demand may be reduced. Some papers have reported research that suggests that the behavior mechanism for reducing a response has been related to habituation. An investigation suggesting that task novelty evoked inappropriate behavior supports this hypothesis. If task novelty can function as an EO, then exposure to the EO and reducing its novelty (thus eliminating the EO) would function as an AO. The results presented by Smith and colleagues (1995) are consistent with this hypothesis. The authors found that problem behavior was higher when a task was initially presented, and that experience with a task functioned as an AO for problem behavior, possibly through habituation.

Another example of habituation to an aversive demand is suggested in data presented by O’Reilly and Carey (1996). The authors evaluated two presession classroom conditions on the results of an analogue functional analysis. Results indicated that presession conditions of continuous demands and escape contingent on aggressive behavior resulted in lower levels of aggressive behavior in the following escape condition of the functional analysis. The authors presented several explanations for the atypical
results, including extinction of escape maintained behavior during a contingent attention presession condition. One additional explanation not suggested by the authors is that habituation to the demands may have contributed to the results if the same demands were used in the presession and analogue conditions. However, the description of the demands was not specific enough to confirm this possibility.

According to McSweeney (2005), satiation literature may also fit into the discussion of habituation. The results of a study by Egel (1981) suggested the role of satiation in the decrease of responding may also be well described as habituation to the reinforcing stimulus. Egel evaluated the effectiveness of constant (same edible reinforcer within and across sessions) and varied (three edible reinforcers rotated within sessions) on the on-task behavior of three students with developmental disabilities. Higher levels of on-task behavior were observed in the varied reinforcement condition compared to the constant reinforcement condition. Results indicated that repeated access to the same reinforcer functioned as an AO for responding maintained by access to that reinforcer. Satiation of the edible item was suggested by decreases in responding across sessions each day. It is possible, however, that the mechanism responsible for behavior reductions was habituation.

*Procedures That Alter the MO for One Response by Creating an EO for an Alternative Response*

Some procedures may increase the value of one response by allowing the participant to control the EO. For example, choice literature will often fit into this category because the reinforcing value of a stimulus increases when a choice between a
stimulus and an alternative are provided. This has also been shown to produce an AO for behaviors that are maintained by escape from the activity. Specifically, if the reinforcer for a response is escape from an activity or task and presenting a choice decreases the escape-maintained response, an AO has been created for escape as a reinforcer. An EO has also been created through this process if engagement in that response or activity were to increase.

Several examples in the choice literature support this hypothesis. For example, Dyer, Dunlap, and Winterling (1990) evaluated the extent to which the opportunity to choose between tasks and reinforcers decreased problem behavior that occurred in the presence of task demands. Results indicated that the opportunity to choose did function to reduce problem behavior while the same tasks and reinforcers continued to evoke problem behavior when no choice was given. Similarly, Dunlap, Kern-Dunlap, Clarke, and Robbins (1991) developed hypotheses about the specific EO responsible for evoking the problem behavior of a teenager with disabilities. They evaluated these potential EOs for problem behavior. Results indicated that task length, task function, task choice, and whether or not the task required gross or fine motor skills all impacted problem behavior displayed during the tasks. In a treatment analysis, they found that presenting a choice of tasks functioned as an AO for escape from the activity while the same tasks continued to evoke problem behavior when a choice was not provided. Finally, Vaughn and Horner (1997) conducted an assessment to determine the preference level of several task demands and then evaluated the effects of teacher-selected versus student-selected sequence of tasks on performance of both high and low preference tasks. Results
indicated that problem behavior remained low when high preference tasks were presented regardless of who selected the sequence. When low preference tasks were evaluated, however, lower levels of problem behavior were observed in the student-selected choice sequence than when the same tasks were selected by the teacher, suggesting the choice functioned as an AO for problem behavior. All of these examples suggest that provision of a choice can function as an AO for problem behavior. Although the presence and effect of the AO are evident in the above examples, the specific relation of the AO and the reinforcer is less clear. It is likely that the reinforcer maintaining problem behavior in each of these examples was escape from the task and that the AO decreased the value of escape as a reinforcer. It was not clear whether the behaviors in these examples were maintained by escape, however, because functional analyses were not conducted. Therefore, the AO decreased the value of some potentially unknown reinforcer and decreased problem behavior maintained by access to that reinforcer.

One additional study seems to highlight the abolishing effects on one response by increasing the EO for a different response. Burzak and Thompson (2007) found that participants allocated more time engaging in stimuli identified as HP, relative to stimuli identified as LP. Each student then observed a peer engaging with a stimulus previously designated as LP. In subsequent sessions, engagement with stimuli designated as LP increased and stimuli designated as HP decreased. Results indicated that observing a peer engage with one stimulus functioned as an EO for that specific stimulus and as an AO for other, more highly preferred stimuli.
Procedures that Produce an AO Through a Biological Basis

Finally, a stimulus or event may function as an AO for responding through a biological basis. For example, it has been shown that certain medicines or health conditions may change the value of a reinforcer and thus function as an MO for a response. These processes can be conceptualized as AOs if the stimulus causes a momentary change in the value of the reinforcer or punisher and decreases behaviors that have led to the reinforcer or punisher in the past.

Methamphetamines may be the most researched stimulus that falls into this type of AO. Research has shown that the presence of this medication can decrease the value of food as a reinforcer (Northup, Fusilier, Swanson, Roane, and Borrero, 1997) as well as other social reinforcers (Dicesare, McAdam, Toner, and Varrell; Northup et al., 1997; Northup et al., 1999). Northup and colleagues completed reinforcer assessments for three boys with ADHD in which each child could chose a reinforcer. The children then received coupons for those reinforcers based on the completion of easy math problems. The presence and absence of methylphenidate (MPH) was manipulated in a reversal design. Results suggested that MPH functioned as an AO for edible reinforcement for two participants. The selection of edible items decreased during the MPH condition for one of the participants. Although another participant continued to select the edible reinforcers, his rate of problem completion (and thus his consumption of edibles) decreased compared to the rate observed during the placebo condition (Northup et al., 1997).
Similar changes in the value of social reinforcers have been observed. Dicesare and colleagues (2005), for example, found that the problem behavior of one participant was maintained by positive reinforcement in the form of access to attention when the student was given a placebo medication. When MPH was present, however, low rates of problem behavior were observed in the attention condition. These results suggested that MPH functioned as an AO, decreasing the value of attention as a reinforcer and decreasing problem behavior maintained by access to attention.

Northup et al. (1997) also found that MPH functioned as an AO for problem behavior maintained by attention for a participant with ADHD, although the value of peer attention was evaluated in this investigation. The authors found that while taking a placebo medication, high levels of problem behavior were observed in the peer prompt condition relative to other functional analysis conditions, suggesting that problem behavior was maintained by access to peer attention. The levels of problem behavior, however, were much lower in the same conditions when the student was taking the MPH medication. Northup et al. (1999) conducted another analysis of the effects of MPH on problem behavior by conducting a functional analysis with four boys with ADHD when the participants were receiving MPH and a placebo, respectively. Results of this study again indicated that MPH abolished the reinforcing value of attention (with two of the participants) and escape (with three of the participants) as reinforcers for problem behavior.

Other health related events and stimuli may have a similar effect on the reinforcing value of a stimulus. In one example of an AO produced through a biological
basis, the medical condition of otitis media was found to have momentary effects on the value of social reinforcers. O’Reilly (1997) conducted a functional analysis of SIB for one participant and found that problem behavior was maintained by multiple sources of social reinforcement when otitis media was present. The absence of the medical condition, however, resulted in lower rates of problem behavior during all conditions. This indicated that the temporary absence of the medical condition functioned as an AO for several social reinforcers maintaining problem behavior.

Similar results have been observed for sleep deprivation. O’Reilly (1995) observed that a participant engaged in higher rates of problem behavior during demand sessions of a functional analysis when the participant had received less than five hours of sleep the night before the assessment. Adequate amounts of sleep resulted in lower levels of problem behavior during demands sessions. These results indicated that adequate sleep reduced the value of, and thus aggressive behaviors maintained by, escape as a reinforcer. Similar observations were made by Kennedy and Meyer (1996). They observed that adequate levels of sleep also functioned as an AO for escape as a reinforcer for problem behavior during a functional analysis. Finally, these authors also identified that the absence of allergy symptoms for another participant functioned as an AO for escape as a reinforcer for problem behavior.

Although other biological conditions may seem to have effects similar to those of an AO, they fail to meet the definition of an AO because they do not produce momentary change in the value of a reinforcer or punisher. Instead, the effects of these variables may produce long-term or permanent value changes. For example, some chronic medical
conditions may increase the value of food as a reinforcer, but these permanently change the value of food.

Implications

Analysis of the literature provides indirect support for many of the characteristics of MOs that have been described, but not systematically investigated. For example, several studies indirectly verify that (a) the value-altering and behavior-altering effects of an MO are separate effects that can be observed independent of one another under the correct conditions; (b) MOs may have multiple and simultaneous effects on different responses, or multiple responses can be affected by the same MO; and (c) MOs create momentary, as opposed to permanent changes in the reinforcing value of stimuli.

Separate Effects of MOs

In an experimental demonstration attempting to isolate the evocative effects of EOs, O’Reilly and colleagues (2006) systematically restricted access to the putative reinforcer maintaining problem behavior. The authors found that problem behavior occurred almost exclusively when access to the reinforcer was restricted before the session. This demonstrated the evocative function of the EO because behavior did not produce access to the reinforcer during the experimental session. McAdam and colleagues (2005) reported results that would suggest the value-altering effect without the evocative effect. In their analysis, satiation and deprivation led to changes in degree of preference for tangible items, suggesting that the values of the reinforcers were reduced and increased, respectively. Consistent with the theoretical discussions provided by Michael (1993; 2007) on the effects of MOs, the results of these two studies provide
preliminary evidence that the two effects produced by MOs are separate phenomena that can be observed independent of one another.

*Multiple Effects/Multiple Behaviors*

Several papers reviewed also demonstrate that one or more MOs can simultaneously affect multiple behaviors and that more than one MO can simultaneously affect the same behavior. In one example, Derby and colleagues (1996) evaluated NCA on a continuous schedule. The results indicated that attention-maintained problem behavior and self-restraint both decreased under this schedule of reinforcement. Additionally, the authors evaluated the effects of attention contingent on SIB and contingent on self-restraint in a reversal design. They observed high levels of SIB, but low levels of self-restraint during the attention contingent on SIB condition, while levels of SIB remained high during the attention contingent on self-restraint condition. These results indicate that the NCA procedure created an AO for both SIB and self-restraint and that providing attention contingent on SIB also created an AO for self-restraint. These data illustrate how the same environmental variable can simultaneously affect multiple responses.

Similarly, Goh and colleagues (2000) conducted functional analyses of the problem behavior of two participants and found that both participants’ problem behavior was maintained by social positive reinforcement. In the treatment analysis, they initiated a dense schedule of NCR with extinction while providing the same reinforcer contingent on manding (i.e., differential reinforcement of alternative behavior; DRA). Because they were trying to determine if the noncontingent schedule would create an AO for
appropriate behavior (i.e., manding), they continued to provide the dense schedule of reinforcement on the noncontingent schedule. Results indicated not only that problem behavior decreased during the NCR condition, but that low levels of appropriate alternative behavior occurred across both phases when the dense schedule of reinforcement was available noncontingently. Increases in appropriate behavior were not observed until the schedule of NCR was thinned in a separate phase by a factor of 6 and 12 for each participant, respectively. Therefore, the NCR treatment decreased the value of attention and a tangible item for each participant, respectively, and decreased both appropriate and inappropriate responses that were reinforced by these stimuli. This illustrates how one stimulus change, the availability of NCR, simultaneously affected motivation to engage in two responses. It is important to note, however, that the two responses measured were part of the same response class, as they both produced the same functional reinforcer.

Additionally, one stimulus change can also have opposite effects on two different responses. For example, Burzek and Thompson (2007) demonstrated that an AO for engagement with one stimulus and an EO for engagement with another stimulus was created when preschool children observed a peer play with one of the stimuli. They initially reported that participants allocated more time to engaging in stimuli that were identified as highly preferred (HP), relative to stimuli identified as low preferred (LP). Each student then observed a peer engaging with a stimulus previously designated as LP. In subsequent sessions, engagement with stimuli designated as LP increased and stimuli designated as HP decreased. Results indicated that observing a peer engage with one
stimulus functioned as an EO for that specific stimulus and as an AO for other, more highly preferred stimuli. Therefore, one stimulus event (i.e., observation of peer play) functioned as an EO and AO for different stimuli.

**Momentary Changes**

Finally, one of the defining characteristics of MOs is that manipulations result in momentary and thus temporary changes in the reinforcing effectiveness of stimuli. After an EO is reduced or removed, the EO may return and thus motivation to engage in the response that was decreased may also return. Results of extended applications of NCR with an arbitrary stimulus (Lindberg et al., 2003), for example, demonstrated that once the EO for a response returns, the behavior may increase.

Much of the literature presented demonstrating the characteristics and effects of MOs occurred prior to the increased attention and interest in motivation in behavior analysis. Therefore, in much of the research presented, the authors did not discuss the role of MOs in their findings. Additionally, very few of the studies were aimed at identifying the behavioral mechanisms involved in the reduction of behavior. Thus, the MOs were not always evaluated independent of other behavior change mechanisms. For example, extinction was combined with the MO manipulations in several of the analyses presented (e.g., Zarcone et al., 1994) and therefore the direct, and sole effects of the MOs can not be directly observed. In these cases, however, support for the role of the MO may be demonstrated indirectly. For example, even though extinction was combined with the stimulus fading intervention in the Zarcone et al. study, the stimulus fading procedure was the sole difference between the two conditions assessed and differential responding.
was observed. Data presented in these studies thus present strong, albeit indirect, support for role of the AO because only one variable was manipulated across conditions.

These procedures highlight an important area for methodological consideration on how the effects of an MO should be evaluated. Several discussions of MOs have led researchers to hypothesize how best to observe the effects of an EO or AO. For example, Laraway and colleagues (2003) and Michael (2000) suggested that the evocative effect of the MO can be observed only before obtaining any reinforcement or during conditions of extinction. The AO effects of some procedures in the current review, however, were observed to occur under conditions other than extinction. In these examples, therefore, the role of the MO may be difficult to interpret and the value-decreasing and behavior-abative effects may be difficult to separate.

The results of this review also reveal that little is known about the ways the AOs may impact CEOs because very little empirical research has investigated CEOs in a systematic way. In the previous AO analysis of existing literature there was insufficient information about the environmental stimuli that evoke behavior as CEOs. For example, the manner in which the stimuli became conditioned to evoke behavior and the reinforcement histories of responses in the presence of these stimuli are not known. Therefore, the impact of AOs on these stimuli is also unknown.

With respect to not having access to the learning history of the organism, one notable exception can be found in data recently presented for an experiment conducted by Hanley, Iwata, and Roscoe (2006). In this analysis, the authors evaluated the stability of preference over time by conducting repeated preference assessments with the same items.
for 3 to 6 months. The results suggested that preference levels were generally stable over
time for seven of the ten participants. After identification of the most stable high and low
preference items for two participants, the authors experimentally manipulated conditions
that may function to increase or decrease the value of these stimuli. Two HP and two LP
stimuli were selected for each participant. One HP stimulus was then presented to the
participant noncontingently for 2 to 3 hours per day (satiation condition), while access to
the other stimuli was not controlled. Simultaneously, one of the LP stimuli for each
participant was paired with known or hypothesized social and edible reinforcers for 15
min per day. Each of the other stimuli from the preference assessment was available
during the conditioning sessions, but was not paired with the reinforcers. Once effects of
the conditions were observed, the remaining HP and LP stimuli for each participant were
placed in the satiation and pairing conditions, respectively. Results indicated that
satiation conditions decreased the value of all four of the highly preferred stimuli and the
pairing procedure increased the value of all four of the LP stimuli. Most of the stimuli
that were not programmed into one of the conditions remained relatively stable. Although
only two of the stimuli (one HP and one LP) for each participant were measured in a
reversal to baseline levels, data presented for these stimuli suggest that the EO and AO
effects were temporary, as preference levels returned to those previously observed in the
absence of the altering conditions. Results of the pairing procedure for LP stimuli suggest
that pairing an item with an HP stimulus will increase the value of the stimulus. Thus it is
suggested that the pairing procedure functioned as a CEO for the stimuli in the
assessment because the stimuli were paired with unconditioned reinforcers (i.e., food).
In the current review, it was impossible to analyze literature with respect to the unpairing procedures because the relation between the conditioned reinforcers, unconditioned reinforcer, UMOs, and CMOs was unknown. The manner in which the stimuli in different studies came to function as conditioned reinforcers cannot be evaluated without knowing the learning history of each participant. The procedures, therefore would be very difficult to initiate in applied settings, and thus are not of practical value (Michael, 2003). As an example, deprivation of attention functions as a CEO-T for the conditioned reinforcer of attention if a state of deprivation evokes responses that have been reinforced with attention. The unconditioned reinforcer(s) with which attention has been paired could include access to food, activities, and warmth, among others. Without the knowledge regarding the learning history of the conditioned reinforcer, it would be impossible to unpair the CEO and the unconditioned reinforcer. If these relations were to be further explored, procedures similar to those employed by Hanley et al. (2006) may make it possible to experimentally pair MOs and conditioned reinforcers to then evaluate the unpairing effects of these stimuli.
CHAPTER 3

METHOD

Participants and Setting

Four students between the ages of 8 and 18 participated in the investigation. All students were referred to a university-based service organization for the assessment and treatment of problem behavior in the classroom. Consent for the project was obtained by the director of the school. Participants were selected for inclusion if teacher or staff reports suggested that the student engaged in problem behavior within task settings. Consent was obtained from each participant’s parent or guardian (see Appendix B for endorsement and consent letters).

Moe was an 18-year-old male diagnosed with autism. He was ambulatory and placed in a self-contained classroom for students with multiple disabilities. Moe communicated primarily in the form of gesturing or picture exchange, although his repertoire also contained approximately five manual signs. Moe was referred for services for the assessment and treatment of SIB, including head banging and head-hitting.
Dee was a 15-year-old female diagnosed with Down Syndrome. She was taking medication for a low thyroid. Dee was ambulatory and was placed in a self-contained special education classroom for students with severe disabilities. There was a picture exchange communication program in place in Dee’s classroom, but she rarely engaged in independent communication. Dee was referred for the assessment and treatment of problem behavior in the form of aggression and dropping to the floor.

Faye was a 13-year-old female diagnosed with moderate mental retardation and controlled myoclonic epilepsy. Faye was ambulatory and was placed in a self-contained classroom for students with multiple disabilities. Faye communicated primarily in the form of informal gestures, but also had a communication repertoire that consisted of approximately three manual signs and two vocal words. Faye was referred for services for the assessment and treatment of aggressive behavior.

Shawn was an 8-year-old male diagnosed with autism. Shawn was ambulatory and placed in a self-contained special education classroom for students with mild to moderate disabilities. Shawn’s primary mode of communication was prompted picture exchange, although he could read a variety of words. Shawn was referred for the assessment and treatment of SIB in the form of hand-biting.

A set consisting of 5 to 10 academic tasks were rotated throughout the preliminary analyses and the motivating operations analysis for each participant. These demands were individually selected for each student based on (a) the individual education plan of the student, (b) teacher report of tasks evoking problem behavior, and (c) direct observation of classroom tasks preceding problem behavior. Demands included
vocational tasks (e.g., putting together bolt and screw) for Moe, academic sorting and matching tasks (e.g., matching picture cards of food items) for Dee, sensory tasks (e.g., rolling play-doh) for Faye, and pre-academic tasks (e.g., matching letters) for Shawn.

All sessions except for the treatment analysis sessions for Shawn were conducted in an empty room that was approximately 8 ft by 8 ft in the participant’s school. Each room contained at least two chairs, a table, and materials necessary for sessions. Treatment analysis sessions for Shawn were conducted in a conference room that contained a large table, several chairs and bookshelves on three of the four walls.

Dependent Variables

Problem behavior and appropriate communication responses were the dependent variables of the experiment. Problem behavior was defined individually for each participant and included aggression and SIB. Appropriate communication responses were also selected and defined separately for each participant. The alternative communication response for each participant was selected based on (a) the student’s current communicative repertoire, and (b) the response effort in relation to that for problem behavior. Alternative communication responses included a picture card touch and picture card exchanges.

Moe’s problem behavior was SIB, which included head-banging (i.e., forceful contact of Moe’s head to any inanimate surface) and head-hitting (i.e., any contact of Moe’s closed hand to any part of his head from a distance of 3 in or any contact of his open hand to any part of his head from a distance of 6 in). A picture card exchange was selected as Moe’s alternative communication response. The picture card was a 2.5 x 2.5
in laminated card with the words “break time” and a picture of a stick person lounging in a chair. An exchange was defined as Moe picking up the picture communication card and placing it into the open hand of the experimenter.

Dee’s problem behaviors included dropping to the floor and aggression. These responses were observed to occur in similar situations and seemed to operate as part of the same response class. For assessment purposes, aggressive behavior served as the primary dependent variable for Dee for several reasons. First, it was difficult to retrieve Dee from the floor when she engaged in a drop, making it difficult to obtain repeated measures. Second, school staff and parents requested that therapists not use lifts to pick her up from the floor. Aggressive behavior included pinching (i.e., at least two of Dee’s fingers closed around the skin of another person) and hitting (i.e., forceful contact between Dee’s hand and any part of another person). A picture card exchange was selected as Dee’s alternative communication response. The picture card was a 2.5 x 2.5 in laminated card with the words “break time” and a picture of a stick person lounging in a chair. An exchange was defined as Dee picking up the picture communication card and placing it into the open hand of the experimenter.

Faye’s problem behavior was aggression, which included pinching (i.e., at least two of Faye’s fingers closed around the skin of another person) and scratching (i.e., any contact of Faye’s fingernails to the skin of another person in a forceful manner). A picture card touch was selected and taught as Faye’s alternative communication response. The picture card was a 2.5 x 2.5 in laminated card with the words “break time” and a picture of a stick person lounging in a chair. A card touch was defined as contact between
any part of Faye’s hand to any part of the picture communication card. During the naturally occurring CEO-R assessment, avoidance responses served as the main dependent variable. Avoidance responses were defined as physical movement of Faye’s chair away from the table or task materials, elopement from the chair, saying “no”, or shaking her head.

The target problem behavior for Shawn was SIB in the form of hand-biting (contact of both Shawn’s upper and lower teeth to any part of his hand, wrist, or arm). A picture card exchange was selected as Shawn’s alternative communication response. The picture card was a 2.5 x 2.5 in laminated card with the words “break time” and a picture of a stick person lounging in a chair. An exchange was defined as Shawn picking up the picture communication card and placing it into the open hand of the experimenter.

Response Measurement and Interobserver Agreement

During the functional analysis, functional communication training (FCT) baseline and treatment sessions, and the timer neutrality assessment, the frequency of problem behavior and independent communication responses were measured using a computerized data collection program. Rate measures for all topographies of behavior were derived by dividing the frequency of responses by the total session duration. During FCT trials, data were collected on the specific prompt level for the communication response during each trial (see data sheet Appendix C). During the MO analysis pairing and unpairing sessions, data were collected on (a) the frequency of FCT responses in the presence of the establishing operation (EO; demand) and the conditioned stimulus (timer), and (b) the frequency of problem behavior (see data sheet Appendix C)
Interobserver agreement was assessed during at least 30% of sessions across all conditions and phases of the investigation. During the functional analysis, the treatment analysis, and the timer neutrality analysis, interobserver agreement was evaluated by dividing the observation periods into 5 s bins and evaluating the extent to which two observers agreed on the exact frequency of target responses within each bin. Exact frequency within intervals agreement was then calculated by dividing the number of intervals with agreements by the number of intervals with agreements plus disagreements and multiplying by 100%. During FCT training and the MO analysis, interobserver agreement was evaluated by determining the extent to which two observers agreed on the prompt level for communication (FCT training), the occurrence or nonoccurrence of a communication response (MO analysis) and the exact frequency of target responses during each trial (FCT training) or FT 60 s interval (MO analysis). Exact agreement within intervals was then calculated by dividing the number of intervals with agreements by the number of intervals with agreements plus disagreements and multiplying by 100%.

The percentage of sessions assessed for interobserver agreement, mean percentage agreement scores and ranges for each participant’s dependent variables are presented in Tables 1-5 (see Appendix C) for the functional analyses, FCT training, treatment analysis, stimulus neutrality analyses, and MO analyses, respectively.

For Moe, 34.1% of functional analysis sessions were assessed for interobserver agreement and mean agreement was 98.6% (range, 99.1% to 100%). During FCT training, 50.0% of sessions were assessed for interobserver agreement and mean agreement was 98.3% (range, 90.0% to 100%). Thirty-one percent of treatment analysis sessions were
evaluated for interobserver agreement. Mean agreement was 97.8% (range, 93.4% to 100%). During the neutrality analysis, 100% of sessions were assessed for interobserver agreement and mean agreement was 97.2% (range, 94.4% to 100%). Finally, 34.3% of the MO analysis sessions were assessed for interobserver agreement and mean agreement was 96.9% (range, 90.0% to 100%).

For Dee, interobserver agreement was assessed during 40.0% of functional analysis sessions. Mean interobserver agreement was 99.9% (range, 99.1% to 100%). During FCT training, 41.7% of sessions were assessed for interobserver agreement and mean agreement was 94.0% (range, 80.0% to 100%). Thirty percent of sessions during the treatment analysis were assessed for interobserver agreement and mean agreement was 97.1% (range, 90.0% to 100%). During the stimulus neutrality assessment, 33.3% of sessions were assessed for interobserver agreement and mean agreement was 100% (range, 100% to 100%). Finally, 31.3% of sessions during the MO analysis for were assessed for interobserver agreement and mean agreement was 94.8% (range, 88.4% to 98.4%).

Interobserver agreement was assessed for Faye during 35.0% of functional analysis sessions. Mean interobserver agreement was 98.7% (range, 96.3% to 100%). During FCT training, 86.7% of sessions were assessed for interobserver agreement and mean agreement was 98.6 (range, 80.0% to100%). Thirty-three percent of sessions during the treatment analysis were assessed for interobserver agreement and mean agreement was 97.1% (range, 94.4% to 100%). During the stimulus neutrality assessment, 34.6% of sessions were assessed for interobserver agreement and mean agreement was 100%.
Finally, interobserver agreement was assessed during 37.7% of the MO analysis sessions and mean agreement was 97.3% (range, 93.7% to 99.2%).

Thirty-three percent of sessions were assessed for interobserver agreement during the functional analysis for Shawn. Mean agreement was 99.3% (range, 98.8% to 100%). During FCT training, 33.3% of sessions were assessed for interobserver agreement and mean agreement scores were 100%. Thirty-three percent of the sessions during the treatment analysis were assessed for interobserver agreement and the mean agreement score was 98.8% (range, 97.7% to 99.7%). During the stimulus neutrality analysis, 50% of sessions were assessed for interobserver agreement and mean agreement was 100%. Finally, during the MO analysis, 33.3% of sessions were assessed for interobserver agreement and mean agreement was 99.5% (range, 98.6% to 100%).

Procedures

Preliminary Analyses

Functional Analysis

A functional analysis similar to the procedures described by Iwata et al. (1982/1994) was conducted for each participant and included five conditions (attention, control, escape, ignore, and tangible). All sessions were 10 minutes in length. In the ignore condition, the participant was in a room with a therapist with no access to materials. There were no programmed consequences for problem behavior. In the attention condition, the participant was in a room with the therapist and was provided continuous access to low preferred tangible items. The therapist did not interact with the participant. Contingent on the occurrence of problem behavior, the therapist delivered 30
s of attention to the participant in the form of reprimands and/or physical attention. In the control condition, the participant was in a room with the therapist and had continuous access to preferred items. Therapist attention was provided in the form of praise statements and positive comments on a FT 30 s schedule. There were no programmed consequences for problem behavior. In the escape condition, the participant was in a room with the therapist. Academic demands were presented on a FT 30 s schedule using a least-to-most prompting procedure. Contingent on correct responses following the verbal and model prompt, brief praise was provided. Contingent on the occurrence of problem behavior, escape from the demand was provided until the next FT 30 s interval was initiated. In the tangible condition, the participant was in a room with the therapist. The therapist did interact with the participant and preferred items were present, but no access was provided. Contingent on the occurrence of problem behavior, the preferred tangible items were presented for 30 s.

*Functional Communication Training (FCT)*

FCT training trials were presented to teach the participant an alternative communicative response to access escape from task demands. Training procedures were similar to those described by Shirley, Iwata, Kahng, Mazeleski, and Lerman (1997). Each session consisted of 10 trials. Following the presentation of each demand, a most-to-least prompting procedure was used to prompt the alternative communication response. A demand was presented, and within 5 s the therapist delivered a physical prompt. Prompt levels were faded from physical to model and from model to vocal prompts, following three consecutive sessions with 80% compliance at each prompt level. Contingent on
both prompted and unprompted communication responses, the demand materials were removed for 30 s and then next trial was initiated. If the participant did not emit the communication response with the current prompt level (e.g., verbal), then the therapist increased prompt levels until the response was emitted (e.g., model or physical). Once 80% compliance was observed for the verbal prompt level for three consecutive sessions, a progressive time delay procedure was initiated until the alternative communication response was emitted in the absence of prompts on 80% of trials for three consecutive sessions. There were no programmed consequences in place for problem behavior and prompting procedures continued if problem behavior occurred in the context of the demand.

Treatment Analysis

Once the communication response was acquired during FCT training, a treatment analysis was initiated to demonstrate the effectiveness of the FCT plus extinction intervention. All sessions were 5 minutes in length and were identical to the escape baseline condition for all participants, except for Shawn as described below.

Escape baseline. This condition was identical to the Escape condition of the functional analysis. There were no programmed consequences in place for appropriate behavior.

Escape to tangible baseline (Shawn only). During the escape intervals, Shawn would frequently leave the chair and run toward the bookshelves to pick up a magazine or phone book. Therefore, Shawn was given access to a phonebook and a reading book during the escape intervals throughout this and subsequent conditions of the analysis.
FCT plus extinction. This condition was identical to the escape baseline condition of the functional analysis, except only the appropriate communication response produced escape from the task demand (or escape to tangibles for Shawn). There were no programmed consequences in place for problem behavior.

Stimulus Neutrality Assessment

Following the treatment analysis, a test for neutrality was initiated to determine if the timer was a neutral stimulus that could be paired with demands in the MO analysis. This test consisted of 2 conditions, and all sessions were 1 minute in length.

Control condition. The control condition was identical to the ignore condition of the functional analysis, except the picture exchange communication card was placed on a table in the center of the room.

Timer condition. Sessions were identical to the control condition of the timer assessment described above, except a beeping timer was presented for 10 s on a fixed-time (FT) 50 s schedule.

Motivating Operations Analysis

Following the training procedure for the alternative communication response, the timer (neutral stimulus) was paired with the establishing operation task demand (EO), until the neutral stimulus acquired value, and evoked communication responses to remove the stimulus.

Pairing

The pairing sessions were similar to the FCT condition of the treatment analysis. On an FT 50 s schedule, a timer was presented and allowed to beep for 10 s. Following
the 10 s timer interval, a demand was presented during a 30 s demand interval using a least-to-most prompting procedure, followed by a 10 s inter-trial interval (ITI). This procedure was repeated 10 times during each session. Contingent on communication responses in the presence of the timer, the timer and all task materials were removed until the 10 s timer and 30 s demand intervals had elapsed, after which the 10 s ITI was initiated. Contingent on communication responses in the presence of the task demand, the task was removed until the end of the 30 s demand interval, and the 10 s ITI was initiated. Compliance to the demand during verbal or model prompts produced brief verbal praise and a break until the end of the 30 s demand interval, and the 10 s ITI was then initiated. If compliance to the demand did occur, and no communication responses were emitted, a least-to-most prompting procedure was used to prompt completion of the requested activity, after which the 10 s ITI was initiated. At the end of the ITI, the timer and the demand were presented as described above. There were no programmed consequences in place for problem behavior, and prompting procedures continued if problem behavior occurred in the context of the demand. This condition continued until the communication response occurred reliably in the presence of the CEO-R (timer), as shown by at least 80% of responses occurring in the presence of the CEO-R.

Unpairing.

The CEO-R (timer) and the demand were then unpaired using two types of unpairing procedures outlined by Michael (2000). The unpairing procedures were evaluated to reduce or eliminate the evocative effects of the CEO-R. Elimination of responses in the presence of the CEO-R (timer) would suggest that the stimulus was no
longer functioning to motivate the occurrence of behavior. During the first unpairing procedure (extinction unpairing), appropriate communication responses continued to produce escape from the timer, but the demand continued to occur at the end of the 10 s interval. In the second unpairing procedure (NCR unpairing), appropriate communication responses continued to produce escape from the timer, but the demand no longer occurred at the end of the 10 s timer interval, regardless of responding. This condition continued until stable responding was observed across two days.

Noncontingent reinforcement (NCR) unpairing. The timer was presented and allowed to beep for 10 seconds. Appropriate communication responses in the presence of the timer produced escape from the timer until the end of the 10 s timer interval. At the end of the 10 s timer interval a 50 s ITI (to equate timer presentations across unpairing conditions) was initiated and the timer was presented again at the end of the ITI. There were no programmed consequences in place for problem behavior during the timer interval or the ITI. This condition continued until stable responding was observed across two days, with the exception of the replication of the NCR unpairing condition for Moe because of time constraints.

Extinction unpairing. On an FT 50 s schedule, the timer was presented and allowed to beep for 10 s, followed by the presentation of a task demand during a 40 s demand interval using a least-to-most prompting procedure and then a 10 s ITI. Contingent on communication responses in the presence of the timer, the timer was removed until the 10 s timer interval had lapsed, and the 40 s demand interval was initiated. Contingent on communication responses in the presence of the task demand, the
task was removed until the end of the 40 s demand interval and the 10 s ITI was initiated. Compliance to the demand during verbal or model prompts was followed by brief verbal praise and a break until the end of the 40 s demand interval, and the 10 s ITI was initiated. If compliance to the demand did not occur, and no communication responses were emitted, a least-to-most prompting procedure was used to prompt completion of the task and the 10 s ITI was initiated. At the end of the ITI, the timer and the demand were presented as described above. There were no programmed consequences in place for problem behavior, and prompting procedures continued if problem behavior occurred in the context of the demand. Problem behavior during the ITI was ignored. This condition continued until the communication response no longer occurred in the presence of the timer or until data suggested that the unpairing procedure was not effectively abolishing the evocative effects of the conditioned CEO.

*Naturally Occurring CEO-R Analysis (Faye only)*

Following the initial MO analysis for Faye, direct observations showed that Faye continued to engage in avoidance responses in the presence of certain materials that were presented in the classroom. The purpose of this assessment was to evaluate the generalization of the most effective unpairing procedure to stimuli that were evoking problem behavior in the natural environment. Thus, the most effective unpairing condition (from the MO analysis) was applied to these materials in the natural environment.

*Descriptive assessment.* Direct observations were conducted in Faye’s classroom to identify a stimulus that was functioning to evoke problem behavior in the natural

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environment. Direct observations consisted of collecting antecedent–behavior–consequence (A-B-C) data to identify stimuli that preceded environmental worsening (i.e., demands) and that evoked occurrence of problem behavior (see data sheet in Appendix C). Conditional probabilities were calculated with one stimulus that frequently occurred prior to demands and the occurrence of problem behavior. Conditional probabilities were calculated by collecting data on the frequency of stimuli presentations, the percentage of these presentations that were followed by problem behavior, and the percentage of these stimuli that were followed by a demand to engage in work. Conditional probabilities for the art materials were 1.0, for being followed by problem behavior, and 1.0 for being followed by a demand presentation. Following identification of these stimuli, the therapist arranged the art materials as described in the CEO-R probe to systematically evaluate the evocative effects of the stimuli.

**CEO-R probe.** To test for the evocative effects of the CEO-R, the experimenter manipulated the naturally occurring environmental event in the same manner as described in the pairing procedure above. The stimuli presented on the FT 50 s schedule in this condition were art materials (two paint brushes, two cups full of paint, two sheets of drawing paper, two crayons, and a bottle of glue). Sessions continued only until the evocative effects of the stimuli were demonstrated (to prevent unnatural pairing of the stimuli).

**NCR unpairing.** This condition was identical to the NCR unpairing condition from the MO analysis, except a timer was no longer presented as the CEO-R. Instead, the art materials identified to be functioning as CEO-Rs in the natural environment during
direct observation were unpaired. Specifically, the art materials (CEO-R) were presented on an FT 50 s schedule. Avoidance behaviors continued to produce escape from the materials, and the demands were no longer presented regardless of responding in the presence of the CEO-R.

Experimental Design

The effects of the five functional analysis conditions were evaluated using a multielement design (Cooper, Heron, Heward, 2007) for each participant. Procedures described by Vollmer et al. (1995) were followed when the multielement functional analysis initially yielded undifferentiated results. These procedures consisted of an extended ignore condition (Moe), and a pairwise comparison between escape and control conditions (Moe and Dee). During the pairwise analysis, a rapid alternation between the escape and control conditions was arranged.

The effectiveness of the FCT plus extinction treatment package was evaluated using a reversal design (Cooper et al., 2007) for each participant. The neutrality of the timer was also assessed using a reversal design.

The effects of the pairing and unpairing procedures were then evaluated using a variation of the reversal design (ABAC) and the order in which the two unpairing procedures were presented was counterbalanced across participants. An additional replication of the most effective unpairing condition was also evaluated for Moe (ABACB) and Shawn (ABACAC) and the naturally occurring CEO probe was applied following the initial ABAC design for Faye.
Procedural Integrity

Observers were trained to collect data on the procedural integrity of the FCT training trials, pairing, and unpairing procedures used in the analyses. This was completed by training observers to collect data on the experimenters’ arrangement of environmental contingencies as described in the procedures. Examples of procedural checklist items included presenting the timer for 10 s during each pairing and unpairing condition, using correct prompting strategies during demand presentations, and providing appropriate consequences for problem behavior and appropriate communication responses. (See Appendix E for procedural integrity checklists.)

Table 6 displays the percentage of sessions with procedural integrity and the percentage of integrity for FCT training and the MO analysis. Procedural integrity was collected for 50.0%, 41.7%, 100%, and 33.3%, of FCT training sessions for Moe, Dee, Faye, and Shawn, respectively. Average integrity was 99.7% (range, 97.9% to 100%) for Moe, 98.9% (range, 94.1% to 100%) for Dee, 100% for Faye, and 100% for Shawn (see Table 6, Appendix C). During the MO analysis, 31.4%, 30.0%, 33.8% and 33.3 % of sessions were evaluated for procedural integrity for Moe, Dee, Faye, and Shawn, respectively. Average integrity was 99.8% (range, 97.0% to 100%) for Moe, 99.9% (range, 98.4% to 100%) for Dee, 99.9% (range, 97.3% to 100%) for Faye, and 100% for Shawn, and (see Table 6; Appendix C).
Social Validity

A questionnaire was administered to relevant consumers (e.g., teachers, aids, and parents). Consumers were asked questions regarding their satisfaction of the assessment and treatment procedures, and whether they would recommend similar procedures for other students in the future.
CHAPTER 4

RESULTS

Preliminary Analyses

Moe

*Functional Analysis*

Results of the multielement functional analysis for Moe are shown in the first phase of Figure 4.1. Levels of SIB were variable in the escape condition, but remained elevated ($M = 0.7$ responses per min (rpm); range, 0.1 to 1.8) relative to the control condition which remained low and stable ($M = 0.03$ rpm; range, 0.0 to 0.2). SIB also remained low and stable in the attention ($M = 0.08$ rpm; range, 0.0 to 0.1) and tangible conditions ($M = 0.3$ rpm; range, 0.1 to 0.5), although the levels in the tangible condition were also slightly elevated relative to the control condition. Moe engaged in very high levels of SIB during the first two conditions of the ignore condition. Although the rates of SIB decreased over the course of the multielement functional analysis, SIB continued to remain elevated in the ignore condition ($M = 1.9$ rpm; range, 0.0 to 3.7) relative to the control condition. Although these data suggested that Moe’s SIB was sensitive to escape as a reinforcer, it was difficult to determine if his behavior was also sensitive to other
contingencies of reinforcement. Additionally, because SIB was elevated in the ignore condition, it was also possible that his behavior was maintained in the absence of social contingencies (i.e., automatically maintained). Therefore, an extended ignore condition was initiated during session 31 (see phase 2 of Figure 4.9) to determine if his SIB would maintain in the absence of social contingencies. Rates of SIB decreased from 0.5 in the final ignore condition of the multielement functional analysis to zero in the first session of the extended ignore condition. SIB remained near zero rates for the 60 min extended ignore session, suggesting that his behavior was not maintained by automatic sources of reinforcement. Finally, a pairwise assessment, comparing escape baseline and control conditions, was initiated during session 36 (see phase 3 of Figure 4.9). SIB remained low for the first two sessions of the escape condition in the pairwise analysis, and then increased significantly ($M = 1.3$ rpm, range, 0.2 to 3.2) while SIB in the control condition remained low ($M = 0.2$ rpm, range 0.0 to 0.3). The data from the multielement functional analysis, the extended ignore condition and the pairwise functional analysis suggested that Moe’s SIB was maintained by negative reinforcement in the form of escape from demands.
Treatment Analysis

The results of FCT training and the treatment analysis for Moe are shown in Figures 4.2 and 4.3, respectively. In the escape baseline condition (see Figure 4.3), rates of SIB were high, but decreased to lower levels and remained at zero for two sessions. Self-injury increased during session 6 and continued to increase for the next three sessions ($M = 1.45$ rpm; range 0.0 to 5.8). Following session 8, FCT training was initiated (see Figure 4.2). Physical prompts to engage in the communication response were delivered following the task demand in the first phase. Moe’s compliance following
the physical prompt was 100% for the first three sessions. In the next phase, a model prompt to emit the communication response was initiated and compliance following the model prompt was 90% in the first session and increased to 100% for the next two sessions. During session 7, the prompt was faded to a verbal prompt and communication following the verbal prompt increased to 90%. Compliance increased to 100% during sessions 8 and 9, and a 5 s delay between the delivery of the task demand and the verbal prompt was initiated during session 10. Moe engaged in the communication response independently during 100% of sessions in the first session and his independent communication remained high for the remainder of the analysis.

Figure 4.2. Results of the functional communication training for Moe.
Following FCT training, the FCT plus extinction treatment was initiated (see Figure 4.3). During the first three sessions of the treatment phase, independent communication increased to high levels, although Moe continued to engage in SIB at high rates. During session 12, SIB decreased to zero and remained low for the remainder of the phase ($M = 0.5$ rpm; range, 0.0 to 1.6), while communication responses remained high and stable ($M = 2.0$ rpm; range, 1.8 to 2.2). During session 17, a reversal to the escape baseline condition was initiated and SIB immediately increased to high levels ($M = 1.5$ rpm; range, 1.0 to 1.8). Communication responses remained elevated initially, but decreased throughout the phase ($M = 0.6$ rpm; range 0.2 to 1.0) and the treatment package was implemented again during session 20. Communication responses immediately increased to high levels, similar to those observed during the previous treatment phase. SIB remained high during the first session and was initially variable. Communication was also initially variable. However, following session 23, communication remained high and stable ($M = 1.4$ rpm; range 0.6 to 1.8) while SIB remained low and stable ($M = 0.4$ rpm; range 0.0 to 1.2).
Figure 4.3. Results of the treatment analysis for Moe.

**Stimulus Neutrality Analysis**

Results of the test for stimulus neutrality assessment for Moe are shown in Figure 4.4. During the first session of the no timer condition in phase 1, Moe engaged in 3 instances of SIB. In the remainder of the no timer condition, however, both SIB and communication remained at zero. During session 5, the timer condition was initiated and Moe emitted one communication exchange during the first session. Zero instances of communication and SIB were observed for the next four sessions and a reversal back to the no timer condition was initiated during session 10. No instances of SIB and communication were observed for three sessions and the timer condition was again
implemented during session 13. Moe’s rates of SIB were initially variable in this phase, but then decreased and remained at zero for the last three sessions of the condition. Communication responses remained at zero throughout the condition. There were no differences between the number of communication or SIB responses emitted in the presence or absence of the timer. Therefore, the timer was considered a neutral stimulus.

Figure 4.4. Results of the neutrality analysis for Moe.

Dee

Functional Analysis

The functional analysis results for Dee are depicted in Figure 4.5. During the first part of the multielement functional analysis (phase 1 of Figure 4.5), Dee engaged in
elevated levels of aggressive behavior during the escape condition ($M = 0.4$ rpm; range, 0 to 1.1). These rates were elevated relative to the control condition ($M = 0.0$). There were no instances of aggressive behavior during the attention, ignore, and tangible sessions. Responding in the escape condition, however, also decreased to zero toward the end of the multielement assessment. A pairwise analysis was initiated during session 22 (phase 2 of Figure 4.1) with a new therapist to compare escape and control conditions. Levels of aggressive behavior increased during the escape condition of the pairwise assessment ($M = 1.4$ rpm; range, 0.4 to 2.4), while levels of aggressive behavior during the control condition remained at zero. Results of the multielement functional analysis and the pairwise assessment suggested that Dee’s aggressive behavior was maintained by negative reinforcement in the form of escape from task demands.
Treatment Analysis

Results of FCT training and the treatment analysis for Dee are shown in Figures 4.6 and 4.7, respectively. During the initial baseline condition (see Figure 4.7), Dee engaged in high, variable rates of aggressive behavior ($M = 1.7$ rpm; range, 0.2 to 4.6) and no instances of appropriate communication. Following baseline, FCT training was initiated (see Figure 4.6). During the first session of FCT training, the therapist delivered a physical prompt to engage in the communication response for a break within 5 s of the delivery of the task demand. Dee complied following the physical prompt during 90% of trials and completed one card exchange independently. Because Dee was attempting to
independently engage in the communication response, a verbal prompt was delivered immediately following the instruction to engage in the task demand in the next phase. Dee engaged in the communication response following the verbal prompt during 100% of trials during this phase, and a 5 s delay between the instruction and the verbal prompt to engage in the communication response was initiated. During the 5s delay to verbal prompt phase, percentage of trials with independent communication increased ($M = 53.3\%$; range, 30% to 50%) and communication responses following the verbal prompt decreased. In the final phase of FCT training, the delay between the delivery of the task demand and verbal prompt was increased from 5 s to 10 s. In the first session independent communication increased to 80%, and decreased to 10% in the second sessions. In the third session, independent communication increased to 90% and remained high and stable for the last three sessions.
Following FCT training, a treatment package consisting of FCT and extinction was implemented (see Figure 4.7). Aggressive behavior immediately decreased to low and stable levels ($M = 0.03$ rpm; range 0.0 to 0.2) and communication increased to high stable levels ($M = 1.0$ rpm; range 0.4 to 1.6). A reversal to the escape baseline condition was initiated during session 15. Aggressive behavior increased slightly during the first two sessions and then increased to high levels during the third sessions ($M = 1.0$ rpm; range 0.2 to 2.4). Initially, communication responses remained high but decreased to zero by the third session ($M = 0.7$ rpm; range 0.0 to 1.6). During the final phase, the treatment package was again initiated. Aggressive behavior immediately decreased to zero and
remained low ($M = 0.0 \text{ rpm}; \text{ range } 0.0 \text{ to } 0.2$), while independent communication immediately increased to high stable levels ($M = 1.2 \text{ rpm}; \text{ range } 1.2 \text{ to } 1.2$).

![Graph showing responses per minute over sessions](image)

**Figure 4.7.** Results of the treatment analysis for Dee.

*Stimulus Neutrality Analysis*

Following the treatment analysis, an analysis to determine if the timer was a neutral stimulus was initiated. Results of the timer neutrality assessment are shown in Figure 4.8. During the first phase, the timer was not present and zero instances of both aggressive behavior and independent communication were observed. In the second phase, the timer was presented on an FT 50 s schedule and again, zero levels of aggressive behavior and communication were observed. A reversal to the no timer condition and
back to the timer condition did not produce any change in responding. Because no
instances of aggressive behavior and independent communication were observed in either
the presence or absence of the timer, the data suggested that the timer was a neutral
stimulus.

Figure 4.8. Results of the stimulus neutrality analysis for Dee.

Faye

Functional Analysis

Results of Faye’s functional analysis are shown in Figure 4.9. Faye displayed
high, variable levels of aggressive behavior during the escape condition (\(M = 2.9\) rpm;
range, 0.1 to 5.7). These levels were elevated relative to the control condition (\(M = 0.0\),
suggesting that Faye’s aggressive behavior was sensitive to escape as a reinforcer. Faye displayed low levels of aggressive behavior during the attention condition \((M = 0.6 \text{ rpm}; \text{ range } 0.0 \text{ to } 2.3)\) in three of the four sessions in this condition. Aggressive responses in the ignore condition were also low \((M = 1.0 \text{ rpm}; \text{ range }, 0.0 \text{ to } 3.7)\) during three of the four ignore conditions. Finally, low levels of aggressive behavior were consistently observed in the tangible condition \((M = 0.3 \text{ rpm}; \text{ range }, 0.1 \text{ to } 0.4)\). These results suggested that Faye’s aggressive behavior was maintained primarily by negative reinforcement in the form of escape from task demands.

![Figure 4.9. Results of the functional analysis for Faye](image-url)
Results of Faye’s FCT training and treatment analysis are shown in Figure 4.10 and 4.11, respectively. During the initial baseline (Figure 4.11), Faye engaged in high, stable rates of aggressive behavior ($M = 3.0$ rpm; range, 1.3 to 5.6) and zero levels of communication.

Following baseline, FCT training (see Figure 4.10) was initiated to teach Faye an alternative communication response to access escape from task demands. During the first phase of training, physical prompts to emit the communication response were delivered within 5 s of the demand. Following 100% compliance at the physical prompt level for 3 sessions, the prompt level was faded so that a model prompt was delivered within 5 s of the task demand. During this phase, Faye’s communication responses following the model prompt were at low levels during the first session and then increased to high levels during the third session and remained above 80% for the last three sessions of the condition. The prompt level was faded to a verbal prompt and Faye’s communication responses following the verbal prompt were high during the first session and remained above 80% for three consecutive sessions. A five second delay between the presentation of the task and the verbal prompt was initiated in the next phase. During the first session, Faye required a verbal prompt to emit the communication response during 50% of trials. Faye’s independent communication responses increased to 80% during the second session and remained above 80% for three consecutive sessions.
Following FCT training, the FCT plus extinction package was implemented (see Figure 4.11). During this condition, aggressive behavior decreased to low levels ($M = 0.2$ rpm; range, 0.0 to 0.4) and independent communication increased to high, stable levels ($M = 2.0$ rpm, range, 2.0 to 2.0). During a reversal to the escape baseline condition, levels of aggressive behavior increased to high stable levels ($M = 1.8$ rpm; range, 1.4 to 2.0). Levels of communication remained high during the first session and then dropped to zero levels for the remainder of the phase ($M = 0.5$ rpm; range, 0.0 to 1.4). Finally, following a return to the FCT plus extinction treatment, aggressive behavior again reduced to low
levels ($M = 0.5$ rpm; range, 0.0 to 1.7) and independent communication was high and stable ($M = 2.0$ rpm; range, 1.9 to 2.2).

![Graph showing responses per minute for sessions](image)

**Figure 4.11. Results of the Treatment Analysis for Faye**

*Stimulus Neutrality Analysis*

Results of the test for stimulus neutrality assessment for Faye are shown in Figure 4.12. During the first six sessions of the no timer condition in phase 1, Faye engaged in elevated levels of both communication responses and aggressive behavior. Following session six, rates of both appropriate communication and aggression decreased to zero for the remainder of the phase. During the first timer condition, no instances of appropriate
communication and aggressive behavior were observed and these responses remained at zero for the remainder of the assessment, as well as during the reversal to the no timer and timer conditions. These results indicate that the timer did not evoke communication responses or aggressive behavior, and suggested that the timer was a neutral stimulus.

![Graph showing responses per minute for Faye](image)

Figure 4.12. Results of the stimulus neutrality analysis for Faye

**Shawn**

*Functional Analysis*

The results of the functional analysis for Shawn are shown in Figure 4.13. Elevated levels of inappropriate behavior were observed in the escape condition ($M = 1.39$ rpm; range 0.9 to 2.0) relative to the control condition ($M = 0.0$), suggesting that
Shawn’s inappropriate behavior was sensitive to escape as a reinforcer. Low, stable rates of inappropriate behavior were observed in the tangible condition ($M = 0.13$ rpm; range 0.1 to 0.2), although these rates were also consistently higher than inappropriate behavior in the control condition. Low to near zero levels of inappropriate behavior were observed in the attention ($M = 0.0$ rpm) and ignore ($M = 0.11$ rpm; range 0.0 to 0.23) conditions also. These results suggest that Shawn’s inappropriate behavior was maintained primarily by negative reinforcement in the form of escape from task demands, although his behavior may also have been sensitive to positive reinforcement in the form of access to tangible items.

![Graph showing combined inappropriate behavior per minute over sessions for different conditions: Control, Ignore, Escape, Tangible, and Attention.](image-url)

**Figure 4.13.** Results of the functional analysis for Shawn.
Treatment Analysis

The results of FCT training and the treatment analysis for Shawn are shown in Figures 4.14 and 4.15, respectively. During baseline, high, but variable levels of aggressive behaviors ($M = 1.1$ rpm; range 0.8 to 1.4) and zero instances of appropriate communication were observed. Following baseline, FCT training was initiated (see Figure 4.15). During the first phase of training, physical prompts to engage in the communication response were delivered immediately following the presentation of a task demand. Following three consecutive sessions with 100% compliance to the physical prompt, a model prompt to engage in the communication response was delivered within 5 s of the task in the next phase. Compliance following the model prompt was 100% for the first three sessions of this condition, and in the next phase the prompt was faded to a verbal prompt. Shawn’s communication following the verbal prompt immediately increased to high levels and remained above 90% for three consecutive sessions. A 5 s delay between the delivery of the task demand and the verbal prompt was initiated during session 10. In the first session of this condition, independent communication increased to 90%, but then decreased to 60% for two sessions. During session 13, independent communication increased to 80% and remained above 80% for three consecutive sessions.
Following FCT training, the FCT and extinction treatment package was initiated (see Figure 4.14). Inappropriate behavior immediately decreased to low levels ($M = 0.0$ rpm; range, 0.0 to 0.2) and independent communication increased to high levels ($M = 1.6$; range, 1.4 to 2.0). A reversal to escape baseline conditions was implemented during session 7 and inappropriate behavior immediately increased to levels above those observed in the initial baseline and remained high throughout the phase ($M = 2.0$ rpm; range, 1.4 to 3.0). Independent communication decreased to slightly lower levels and remained stable ($M = 0.67$ rpm; range, 0.6 to 0.8). The treatment package was again initiated during session 10 and communication immediately increased to high and stable
levels (\(M = 1.9\) rpm; range, 1.8 rpm to 2.0), while inappropriate behavior immediately decreased to near zero levels (\(M = 0.0\) rpm; range, 0.0 to .0.2). These data suggested that the treatment package was effective in reducing inappropriate behavior and increasing alternative communication response to access escape from task demands.

![Graph](image)

**Figure 4.15.** Results of the treatment analysis for Shawn.

*Stimulus Neutrality Analysis*

Following the treatment analysis, an assessment was initiated to evaluate whether the timer was a neutral stimulus. Results of the stimulus neutrality assessment for Shawn are shown in Figure 4.16. During the first phase, the timer was not present and no
instances of inappropriate behavior or independent communication responses were observed. During the next 3 sessions, the timer was presented on an FT 50 s schedule and Shawn’s inappropriate behavior and independent communication remained at zero. During session 7, the timer was removed and levels of independent communication remained at zero; inappropriate behavior increased slightly during sessions 8 and 9, but remained low. Finally, during session 10, the timer was again introduced and zero instances of both independent communication and inappropriate behavior were again observed. These data suggested that the timer was a neutral stimulus that did not evoke either inappropriate behavior or independent communication.

Figure 4.16. Results of the stimulus neutrality analysis for Shawn.
Motivating Operations Analysis

*Moe*

Results of the MO analysis for Moe are displayed in Figure 4.17. Following 5 trials in the first session of the pairing condition, Moe began to emit the communication response in the presence of the conditioned stimulus on a few trials during the first session. Communication responses in the presence of the conditioned stimulus quickly increased throughout this phase and remained high and stable for the last 5 sessions of this phase. The NCR unpairing condition was initiated during session 9. Communication responses in the presence of the conditioned stimulus remained high during the first session, and then quickly decreased. Some variability was initially observed and then responding continued to decrease until zero communication responses were observed in the presence of the conditioned stimulus for the last 5 consecutive sessions. During session 25, the pairing condition was initiated to reestablish the value of the conditioned stimulus. Communication in the presence of the conditioned stimulus initially remained low and then increased and became stable at 10 responses in the presence of the stimulus per session for the last 4 sessions of the condition. During session 40, the extinction unpairing condition was initiated. There was not an immediate change in the frequency of communication responses in the presence of the conditioned stimulus and responding remained similar to levels of responding observed during the end of the pairing condition. After communication in the presence of the conditioned stimulus remained high and stable between 9 and 10 per session for 16 consecutive sessions, this condition was terminated. During session 56, the NCR unpairing condition was again initiated to
replicate the initial findings of this condition. Responding in the presence of the conditioned stimulus remained high initially and then began to decrease with variability throughout this phase until zero responses in the presence of the stimulus were observed at the end of the condition. The replication of the NCR unpairing condition resulted in a similar pattern of responding in the presence of the conditioned stimulus, although slightly more variability was observed in the second NCR unpairing condition. These data suggest that the NCR unpairing was effective in reducing communication responses evoked by the conditioned stimulus. The extinction unpairing condition, however, did not have any effect on the number of communication responses emitted in the presence of the conditioned stimulus.
Figure 4.17. Results of the motivating operations analysis for Moe.

Dee

The results for the motivating operations analysis for Dee are displayed in Figure 4.18. During the first three sessions of the pairing condition, Dee emitted communication responses only in the presence of the EO. During session 4, she began to emit the communication response in the presence of the conditioned stimulus and communication responses continued to increase until a majority of the responses occurred in the presence of the stimulus during session 11. Communication responses remained stable between 8 and 9 responses per session for the last 5 consecutive sessions, and the NCR unpairing
condition was initiated during session 16. There was an immediate decrease in communication responses in the presence of the conditioned stimulus during the first session of the unpairing, and the responses continued to decrease until zero responses occurred in the presence of the stimulus during session 21. Communication remained at zero for the next 5 consecutive sessions. During session 26, the pairing condition was again initiated to reestablish the stimulus as a conditioned stimulus. Communication in the presence of the conditioned stimulus immediately increased to 5 during session 26, and continued to increase until a majority of the responses were again occurring in the presence of the conditioned stimulus. Communication remained high and stable for the next 6 sessions and the extinction unpairing condition was initiated during session 34. High levels of communication responses in the presence of the conditioned stimulus were initially observed, and then responding decreased and continued to decrease until zero communication responses were observed in the presence of the conditioned stimulus during sessions 53 and 54. Following these two sessions, however, communication responses became slightly more variable and began to increase. Responses became more stable and remained between 1 and 5 per session during the last 19 sessions, and the unpairing condition was terminated. Results of this condition suggest that the NCR unpairing condition was effective in abolishing the value of the conditioned stimulus and reducing responses in the presence of the stimulus. The extinction unpairing was also effective at reducing the frequency of responses in the presence of the stimulus, but responding in this condition was never completely abolished.
Figure 4.18. Results of the motivating operations analysis for Dee

**Faye**

The results of the MO analysis for Faye are shown in Figure 4.19. During the pairing condition, Faye’s communication in the presence of the conditioned stimulus initially remained low and variable. Increases in communication were observed for several sessions, followed by a decrease in responding to lower levels. Responses remained between 3 and 7 per session during the next 8 sessions and during session 20; the therapist began blocking Faye’s head rubbing (which continued throughout the remainder of the assessment). Faye’s communication responses in the presence of the conditioned stimulus increased for the remainder of the phase, until communication
responses remained above 8 per session for 5 consecutive sessions at the end of this phase. During session 30, the first set of the extinction condition was initiated. Faye’s communication responses in the presence of the conditioned stimulus began to decrease and this downward trend in responses continued until session 41. Following session 41, responses became highly variable and remained variable throughout the remainder of the condition. Following 40 sessions (after 6.6 hours of experience in this condition), the unpairing phase was terminated and the pairing condition was again initiated to establish a stable frequency of responding in the presence of the conditioned stimulus. Communication responses in the presence of the conditioned stimulus immediately increased to 8 per session and remained high and stable during the remainder of this condition. During session 78, the NCR unpairing condition was initiated. Communication responses in the presence of the conditioned stimulus decreased throughout the condition with some variability. Responses in the presence of the conditioned stimulus were then decreased to near zero following sessions 98, and remained low for the remainder of the condition. During session 109, a phase of CEO-R probes was initiated with stimuli in the natural environment (i.e., art materials) that were hypothesized to evoke avoidance behaviors. Avoidance behaviors were high and stable during the probe sessions, and the NCR unpairing condition was initiated with these stimuli during session 112. Initially, avoidance behaviors in the presence of the CEO-R decreased slightly, but remained variable between 4 and 9 responses. During session 122, avoidance behavior in the presence of the CEO-R decreased to 1 per session and remained low and stable for the remainder of the condition. Results of these data suggest that the extinction unpairing
condition reduced responses in the presence of the conditioned stimulus, although not to consistently low levels. The NCR unpairing condition, however, effectively reduced responses in the presence of the conditioned stimulus (timer) and naturally occurring conditioned stimuli (art materials).

Figure 4.19. Results of the motivating operations analysis for Faye.
**Shawn**

The results for the MO analysis for Shawn are shown in Figure 4.20. Following 7 trials in the first sessions, Shawn engaged in the communication response in the presence of the conditioned stimulus during 2 trials. The number of communication responses in the presence of the conditioned stimulus increased throughout the pairing phase until, by session 6, communication the presence of the conditioned stimulus occurred during 8 of the 10 trials. Shawn’s communication remained high and stable in the presence of the stimulus for the next 6 sessions. During session 12, the extinction condition was initiated to decrease the evocative effects of the conditioned stimulus. Communication responses in the presence of the conditioned stimulus initially remained high and then began to decrease. By session 18, zero communication responses occurred in the presence of the conditioned stimulus. Following this initial decrease, however, responses became higher and more variable for the remainder of the condition. The extinction unpairing condition was terminated and the pairing condition was again initiated during session 37.

Communication responses in the presence of the conditioned stimulus were high, but slightly variable in the first few sessions and then communication increased and remained stable at 10 responses per session for the next 4 consecutive sessions. During session 43, the NCR unpairing condition was initiated. Shawn’s communication responses in the presence of the conditioned stimulus initially remained high and then decreased rapidly with some variability. Communication in the presence of the conditioned stimulus decreased to zero in session 50 and remained stable at zero for the last 7 consecutive sessions on this condition. During session 57, the pairing procedure was again initiated.
Communication in the presence of the conditioned stimulus initially remained low and then increased and remained stable at 9 responses per session for the last three sessions of the condition. The NCR unpairing was initiated to replicate the findings from this condition during session 63. Communication decreased with some variability throughout this phase until zero responses occurred in the presence of the stimulus for the last 5 consecutive sessions. These data suggest that the NCR unpairing condition was effective in abolishing the effects of the conditioned stimulus. The extinction unpairing condition was also initially effective in reducing the effects of the conditioned stimulus. Responding in this condition, however, suggested that the unpairing was not effective in reducing the value of the conditioned stimulus toward the end of the condition.
Figure 4.20. Results of the motivating operations analysis for Shawn
CHAPTER 5

DISCUSSION

Preliminary Analyses

All participants engaged in high levels of inappropriate behavior during the demand conditions relative to the control conditions in either a multielement functional analysis or a subsequent pairwise functional analysis. Results of these assessments demonstrated that the inappropriate behavior of all participants was maintained primarily by negative reinforcement in the form of escape from task demands. Subsequently, a treatment package of FCT plus extinction resulted in high levels of communication and low levels of problem behavior, demonstrating an effective intervention for problem behavior. Finally, during a neutrality assessment, similar levels of appropriate and inappropriate behavior were observed in the presence and absence of the timer for each participant, respectively. These data suggested that the timer was a neutral stimulus that did not evoke either of the target behaviors in the response class of interest for any of the individuals.

Results of the preliminary analyses (functional analysis, FCT, treatment analysis, and neutrality assessment) of the current investigation were important for empirically
contriving conditions to evaluate a CEO in the subsequent MOs analysis. First, results of the functional analysis were important in demonstrating that the presentation of demands functioned as an aversive event for all participants. During analogue functional analyses (Iwata et al., 1982/1994), potential EOs are presented and the target response results in the removal of the EO. This methodology is used to determine the variables responsible for maintaining the target response. In the escape condition, the EO presented is typically a task demand (or other aversive event) and responses are reinforced by the removal of the EO. In the functional analyses of the current investigation, all participants engaged in high levels of inappropriate behavior during the escape condition relative to the control condition. Thus, results suggested that demands functioned as EOs that evoked occurrences of problem behavior. It is clear that these EOs were aversive events that each individual would emit responses to escape or avoid.

This assumption is important because the subsequent worsening (or improving) of an individual's environment is a characteristic of a CEO-R (Michael, 2000; 2007). To ensure that the neutral stimulus would be paired with a “worsening” environment an empirical demonstration that demands were functioning as a putative EO that evoked escape responses was necessary. Thus, a stimulus paired with these aversive events could be conceptualized as a CEO-R if the stimulus paired with the EO began to evoke behaviors that had previously been reinforced with escape from the EO.

During FCT, each participant was taught a response that was functionally equivalent to the responses evoked by the EO. Specifically, each participant was taught a response to access escape from the putative EO. This evaluation enabled assessment of
the properties of the conditioned EO without conditioning a neutral stimulus to evoke occurrences of problem behavior (which would clearly have been unethical to the participants and potentially harmful to the researchers). Also, because these responses were directly taught during this investigation, the reinforcement history of the response was known for all participants. Specifically, the response was taught within the current analysis and produced reinforcement on a continuous schedule. This is important because the communication response served as the main dependent variable, as a measure of the EO strength, in the MOs analysis. This is also important when comparing the results of the MO analysis for each participant. The responses and histories of reinforcement were not only known, but were identical among participants, allowing these variables to be ruled out as idiosyncratic variables that may have affected results.

Finally, one of the purposes of the MO analysis was to pair a neutral stimulus with an aversive event to determine if the neutral stimulus would acquire value from the EO to function as a CEO. Therefore, during the stimulus neutrality analysis, the hypothesized neutral stimulus (timer) was empirically evaluated to determine if it was a neutral stimulus that could be used in the subsequent MO analysis. Results indicated that it did not evoke either member of the relevant response class (appropriate or inappropriate behaviors maintained by escape from tasks), and was determined to be neutral for all participants. These results suggested that the stimulus could be paired with the EO in the MO analysis. The demonstration of this stimulus as neutral was also important in knowing the reinforcement history of the participants with respect to the stimulus. Its demonstrated neutrality suggested that it had not consistently been paired
with reinforcers, punishers, or other stimuli in the environment. Therefore, it could be assumed that relevant history of the stimulus, for the purposes of this investigation, was known and was equal for all participants prior to the MO analysis.

**Motivating Operations Analysis**

When the neutral stimulus (timer) was paired with aversive demands, all participants began to engage in communication responses in the presence of the stimulus, demonstrating that the stimulus acquired value as a CEO. A CEO is a stimulus or event whose value- and behavior-altering effects are a result of a learning history. More specifically, the conditioned stimulus would meet the requirements of CEO-R, which is defined as a stimulus or event that is paired with an improving or worsening environment (Michael, 2000; 2003; Laraway et al., 2003). The timer acquired value of the upcoming event (demand), established its own removal as a reinforcer, and evoked responses that led to its removal.

Following successful pairing between the CEO-R and the EO, two methods were evaluated to unpair the relation between the stimuli. Successful unpairing would result in a decrease in the responses evoked by the CEO-R. Thus, data were collected on the number of communication responses each participant emitted in the presence of the CEO-R during the unpairing phases as a measure of the relative strength of the CEO.

During the NCR unpairing condition, when the CEO-R was continuously presented in the absence of the EO (i.e., noncontingent escape from the EO was provided), the communication responses of all participants decreased. The results demonstrated that this form of unpairing functioned to reduce the value of the CEO-R. In
fact, responding by all participants was decreased to zero. This unpairing condition was also effective in reducing the frequency of avoidance behaviors evoked by a naturally occurring CEO-R (i.e., art materials) for one participant (i.e., Faye).

Effects of the extinction unpairing condition were less clear. During this condition, when the communication responses in the presence of the CEO-R were no longer reinforced by avoidance of the EO, communication responses were variable both within and across participants. Results for 1 of the 4 participants (Dee) suggested that these procedures decreased the value of the CEO-R, as communication responses in the presence of the stimulus were much lower during this condition relative to the pairing condition. Her communication responses, however, never decreased to zero and thus the value of the CEO-R was never completely abolished. In addition, when compared with the rate of decrease in the NCR unpairing condition for Dee, the extinction unpairing was much less effective. Results for 2 of the 4 participants (Faye and Shawn) suggested that the conditions were initially effective in reducing the value of the CEO-R, as shown by initial decreases in communication responses in the presence of the CEO-R when this condition was initiated. Results for both of the participants, however, showed that after the initial decreases, responses became variable and the conditions ended with increases in the communication responses. These data suggested that the CEO-R was reestablished, and communication responses for both participants eventually increased to levels similar to those observed in the pairing condition. Finally, results for the fourth participant (Moe) suggested that the extinction procedure was completely ineffective in reducing the value of the CEO-R. During this condition, Moe continued to emit the communication response
in the presence of the timer during a majority of trials throughout the entire unpairing phase. Data suggest that the CEO-R was operating with full strength, as the responses were evoked during almost 100% of intervals in which the stimulus was presented.

Both of the procedures that were evaluated to unpair the relation between the CEO-R and the EO were effectively functioning as AOs for all participants, with the exception of the extinction unpairing for Moe. An AO is an antecedent event that decreases the value of a stimulus and decreases the frequency of responses that have previously led to reinforcement (Michael, 2000; Laraway 2003). This is clearer with the NCR unpairing condition which led to marked decreases in responses in the presence of the CEO-R (timer and art materials) for all participants. This may be less clear in the extinction unpairing condition, but data revealed that the frequency of responses generally decreased during this condition for 3 of the 4 participants relative to the pairing condition. To meet the behavioral definitions of an AO, it is not necessary to completely abolish the value of the stimulus functioning as an EO. In fact, most MOs actually fall on a continuum, and one measure of the strength of the MO would be the relative frequency of responses evoked by its presence. Therefore, the strength of the CEO-R during the pairing conditions was high for all participants (as shown by a high frequency of responses evoked by the CEO-R), while the strength of the CEO-R during the extinction unpairing condition was not as powerful (as shown by the lower frequency of responses evoked by the CEO-R.)
Relation to Previous Basic Research

Similar to data presented on a warning stimulus preceding shocks (Sidman, 1955), the pairing of a neutral stimulus with an aversive demand resulted in responses evoked by the stimulus. The data collected during the MO analysis suggested that the stimulus was conditioned to function as an EO. In addition to the establishing properties that were conditioned, the stimulus may have also become conditioned as an $S^d$. In fact, the conditioned stimulus may have served multiple functions for the student. Although the timer did not signal that escape from the timer was available, it did signal the availability of avoidance from the demand (as an $S^d$). Avoidance training typically involves presenting the EO on a response independent schedule. Any responses in the presence of the EO result in escape and any responses in the interval preceding the EO result in a delay of the onset of the next scheduled EO (Sidman, 1955). The latter part of this avoidance training did not occur in this investigation and responses during the ITI were ignored. Thus, when the external stimulus was introduced, it may have signaled to the student that the avoidance reinforcer was available for responding. Alternatively, or simultaneously, the stimulus was functioning as an EO.

The data presented for the extinction unpairing condition shed some additional light on the putative reinforcer maintaining responding in the presence of the CEO-R. When the availability of the reinforcer (avoidance) was no longer signaled by the CEO, the CEO continued to function to evoke behavior for all participants, suggesting that it was not the reinforcer maintaining the response. It is also important to note that the
communication responses were rarely observed during the ITI for 3 of the 4 participants (Moe, Faye, and Shawn) and remained low and stable across conditions for Dee.

Data from the current investigation also extend basic research on abolishing the value of, and reducing behaviors evoked by, a CEO. Results for the NCR unpairing condition replicate results of basic research investigating extinction of avoidance responding (Sidman, 1957; Schnidman, 1968). Extinction in these investigations occurred by first training rats in a discriminated avoidance procedure with a warning stimulus. During extinction, shocks no longer followed the warning stimulus. This procedure was similar to the NCR unpairing condition evaluated in the current investigation. Results of Sidman (1955; Schnidman, 1968) suggested that unpairing a CEO and the UEO would result in a decrease in responses evoked by the CEO. The current investigation extends this finding to applied stimuli and behaviors. Results of Schnidman (1968) also indicated that the responding during “extinction” was related to the strength of the response during conditioning. In the current research, the response strength was never high or completely stable before implementation of the unpairing conditions. Specifically, the maximum number of communication responses in the presence of the CEO was 10 in any session. Communication responses were never stable at 10 responses per session for more than 4 sessions before the introduction of the NCR unpairing condition. Therefore, each participant contacted the contingency in the this condition within a few sessions and it is unclear if these conditions would have resulted in a slower unpairing if these responses had been maintained at higher strength. It is possible that the NCR unpairing condition
may not have been as effective if the strength of the communication response was at a
higher before to implementing the unpairing condition.

Just as the NCR unpairing condition replicated results reported in basic literature,
data for the extinction unpairing condition are also similar to results reported on response
independent pairing between a neutral stimulus and aversive stimulus in basic research.
In a study by Orme-Johnson and Yarczower (1974) “yoked pigeons” received a shock
noncontingently whenever “punishment pigeons” received a shock contingent on a
response. Shocks were preceded by illumination of a red light for both yoked and
punishment pigeons. Subsequently, the red light was presented contingent on responding
for both the yoked and punishment pigeons. Data suggested that the red light actually
functioned as a more effective conditioned punisher for the yoked pigeons, for whom the
red light had been always been presented independent of responding independently. The
procedures in the extinction unpairing condition were analogous to the procedures
employed for the yoked pigeons in the Orme-Johnson and Yarczower investigation.
Specifically, the EO (demand) in the unpairing condition was presented on a response
independent schedule and the conditioned stimulus (timer) preceded every occurrence of
the EO. Similar to the results reported by Orme-Johnson and Yarczower, it is possible
that the temporal relation between the stimuli (CEO and EO) was enough for the
conditioned stimulus to remain aversive, thereby accounting for the continued responding
in the presence of the CEO during this condition.
Applied Implications

The results of the current investigation have major implications for stimuli in the natural environment that typically precede aversive events, especially for students who engage in problem behavior that is maintained by negative reinforcement. The neutral stimuli in the current investigation acquired value and began to evoke communication responses following pairing with a known aversive EO for all participants. It is possible that stimuli in the natural environment quickly acquire value of the aversive EOs that they precede. For example, a teacher walking toward a student in the classroom or the presentation of certain task-related materials almost always precedes a demand. When these demands are aversive and evoke problem behavior reinforced by removal of the demand, the stimuli that precede them may quickly acquire value and evoke the same responses. This is further supported by the demonstration that art materials, which frequently preceded demands, consistently evoked avoidance behaviors for one of the participants in the investigation (Faye). It is even possible that broader events and stimuli will acquire value. For example, rooms in a school or the school building itself may become paired with aversive events and evoke responses that result in escape from these environments and avoidance of the aversive events.

In fact, results of the current investigation may extend research on stimuli that are programmed to signal changes in the environment as a treatment for problem behavior. For example, McCord, Thompson, and Iwata (2001) found that the SIB of two participants was maintained by avoiding transitions that included location changes. As a treatment, the researchers evaluated giving the participants advance notice of the
transition. Results indicated that providing advance notice of the aversive event (transition) had no impact on SIB, although a subsequent consequence intervention including differential reinforcement, extinction, and blocking was effective.

The results of the current investigation may provide insight as to why the advance notice intervention was ineffective. Essentially, the researchers paired a verbal stimulus (the advance notice) with an aversive EO (the transition). Results of the current investigation suggest that the verbal stimulus may quickly acquire aversive value and may begin to evoke the avoidance behaviors as a CEO-R instead of decreasing the inappropriate behaviors. Others have found similar results when providing advance warnings to decrease problem behavior during transitions hypothesized to be maintained by escape from the transition (Cote, Thompson, and McKerchar, 2005), and problem behavior during transitions maintained by termination of a preferred activity and escape from a nonpreferred activity (Wilder, Chen, Atwell, Pritchard, & Weinsten, 2006). It is important to note that some investigations have found that providing advance notice of a transition was an effective means of reducing problem behavior during transitions. For example, Tustin (1995) compared providing a 2 min warning for an upcoming change in activity with providing no warning of the change. Results indicated that stereotypic behavior occurred only during changes in activity without the warning.

There may be several potential variables involved in maintaining problem behavior that occurs during transitions or changes in activity. The specific aversive aspect of the transition was evaluated during the investigation by McCord et al. (2001) and similar assessments were conducted in the investigation by Wilder et al. (2006). The EO
may be (a) initiation of the physical transition, reinforced by escape from the transition, (b) termination of a preferred activity, reinforced by continued access to that activity, or (c) avoidance of a nonpreferred upcoming activity, reinforced by escape from that activity (McCord et al; Wilder et al.). Another possibility is that the unpredictability of the transition (or schedule) is the EO that is evoking problem behavior, reinforced by escape from the unpredictable environment. In these latter situations, advance notice of the transition may be beneficial in reducing the aversiveness of the EO. However, responses that are maintained by escape from the transition or escape from the activity change during a transition may not be affected by the advance warning. In fact, results of the current study suggest that the warning may become conditioned as a CEO-R, signaling a worsening of the environment. If so, it may evoke problem behaviors that remove the CEO-R (warning) and avoid the transition. This possibility of different EOs evoking behavior may explain some of the variability observed in previous research when advance notices of transitions have been provided as treatment for problem behavior.

The results of the current investigation also extend the applied literature on conditioned punishment. Conditioned punishment may be an efficient means to enhance the effectiveness of, and decrease the ethical concerns about, using punishment procedures (see Lerman & Vorndran, 2002, for a review). Procedures that have evaluated conditioned punishers in an applied context have paired neutral or less aversive stimuli or procedures with more aversive, effective punishers. Results indicate that when the conditioned stimuli are subsequently presented contingent on behavior, that behavior can be suppressed. Results of the current investigation are relevant to the clinical application
of such procedures. Specifically, results of the pairing and unpairing of conditioned aversive stimuli are useful for helping to evaluate the processes by which punishers become conditioned and how they may lose effectiveness.

To date, much of the research on conditioned punishment has been in the basic laboratory with rats and pigeons (Lerman & Vorndran, 2002). There have been a few exceptions in the applied literature. For example, Lovaas and Simmons (1969) paired the verbal stimulus “no” with the presentation of shock for one participant who engaged in SIB. Results of this study indicated that the stimulus “no” decreased SIB in the absence of the unconditioned punisher across multiple researchers in two settings. These data suggest that the simultaneous pairing of a neutral stimulus and an unconditioned punisher was effective for the neutral stimulus to acquire aversive value and function as a conditioned punisher after just a few instances of pairing.

In a more controlled demonstration, Dorsey, Iwata, Ong, and McSween (1980) first demonstrated that contingent water mist functioned as an effective punisher for the SIB of 7 participants. The verbal stimulus “no” was then paired with the water mist and a differential reinforcement procedure. Results indicated that the verbal stimulus alone was not an effective punishing stimulus during baseline. Following pairing, however, the verbal stimulus was effective in reducing SIB when the stimulus was presented in the absence of the water mist. The differential reinforcement component of the treatment package was ruled out as being the effective component when the reinforcement procedure was subsequently implemented in the absence of “no” and the water mist in one of the two locations for each participant. These results indicated that a procedure that
paired a previously neutral verbal stimulus with an aversive stimulus shown to function as an effective punisher was sufficient for the stimulus to acquire value as an aversive stimulus and to decrease behaviors that the conditioned stimulus followed. Again, very few sessions occurred presenting the verbal stimulus in the absence of the unconditioned punisher.

Finally, in an investigation on the generalization and maintenance of a conditioned punisher, Vordran and Lerman (2006) paired a less intrusive procedure (LIP) with a procedure shown to function as an effective punisher (walking) for one participant. Results indicated that the LIP was conditioned as an effective punisher following 15 pairing sessions for one participant and maintained for 56 sessions in two settings without additional pairing. For the second participant, the LIP was also conditioned as a punisher through pairing with an effective punisher (facial screen). For this participant, however, a less durable effect was observed, as the punisher was effective for only 14 sessions in the absence of pairing.

Data in the current investigation provide some evidence for the pairing methods used to establish conditioned punishers. Similar to a procedure applied by Vorndran and Lerman (2006), a neutral stimulus was presented immediately prior to the onset of the aversive stimulus on a response independent schedule. Vordran and Lerman showed that this method was effective when they paired the LIP with an effective punisher for both participants. Others have used a simultaneous method (e.g., Lovaas et al., 1969) and have also found favorable conditioning effects. However, the continued application of a punisher conditioned using the latter method has not been investigated.
The efficiency of the NCR unpairing condition is also directly relevant to literature on conditioned punishment. The application of a conditioned punisher in the absence of the unconditioned punisher is essentially identical to the NCR unpairing procedure evaluated in the current investigation. This information is important for clinical applications of conditioned punishers to determine schedules of continued pairing of the conditioned punishers with the unconditioned punishers in order to maintain effectiveness.

The results of the current investigation suggest that the long term application of a conditioned stimulus following pairing with an aversive stimulus may be less effective than suggested by the findings of Vorndran and Lerman (2006). The conditioned stimulus in the current investigation quickly lost value in the absence of continued pairing. The stimulus actually lost value (as shown by the 50% reduction of behaviors evoked by the stimulus) within an average duration of 7.8 sessions (range, 3 to 21). Therefore, these results provide additional evidence that a stimulus functioning as a conditioned punisher is not likely to continue to function as a punisher in the absence of continued pairing.

Future Research

The results of the current investigation, albeit preliminary, are important because they provide empirical support for the conceptual framework that has been set forth regarding motivation. Very few applied investigations have systematically evaluated CEOs or the effects of AOs on CEOs. Those that have did not discuss the role of motivation or link these results to the conceptual framework.

Data from the current investigation suggest that unpairing the relation between a CEO and another EO may be an effective method of reducing behaviors that are evoked
by a CEO. Extinction of the response in the presence of the CEO should also decrease the frequency of responses in the presence of the stimulus. This would consist of the discontinuation of the reinforcer for the communication response in the presence of the CEO-R. The immediate reinforcement for the communication response in the presence of the CEO-R would be the removal, or escape from, the CEO-R. Across all conditions, the CEO-R was removed contingent on responding, thus extinction in this form was never evaluated. Extinction of the avoidance response, however, was evaluated in the extinction unpairing. Responses in the presence of the CEO-R continued to produce the immediate reinforcement of escape from the CEO-R, while avoidance of the EO contingent on responding was placed on extinction. Data suggested that this unpairing was less effective than the NCR unpairing, which may provide additional support for the hypothesis that the reinforcer maintaining the response was the immediate removal of the CEO-R. Responding continued when this was the only reinforcer presented, which may account for why responding continued in the extinction unpairing condition.

A CEO-R is a stimulus or event that is paired with either the worsening or improvement of an environment. In the current investigation, only the latter was evaluated. It is unknown if similar procedures would have resulted in conditioning a stimulus in the opposite direction as quickly as observed with the CEO-R in the current study. Previous investigations have found that pairing a low preference item with preferred social reinforcers increases the value of the LP stimuli (Hanley, Iwata, & Roscoe, 2006). In another analysis of pairing reinforcement, Solberg, Hanley, and Layer (2007) found that preference for LP items shifted when additional sources of
reinforcement were paired with less preferred items and subsequently faded. In both of these investigations, an EO was created by pairing reinforcers, although these increases were not maintained in the absence of the paired stimuli. As these authors pointed out, the conditions necessary for creating conditioned reinforcers are not clearly described or investigated. One possibility would be to investigate a pairing method in which one stimulus signals the improving of the environment, as a CEO-R. This may create a more effective, and possibly more durable conditioned reinforcer.

The EO in the current investigation was task demands. These demands were shown to be aversive events evoking escape responses during the functional analysis. A neutral stimulus was then paired with this EO to change the value of the stimulus. It is possible that a demand functions as a UEO because the child is forced to stay in a situation, is prompted, and possibly physically guided to respond (Michael, 2000). It is also possible, however, that the academic demand is itself a CEO that has been paired with either the restriction of other forms of reinforcement (physical activity or restricted access to preferred items), punishers (for poor performance), or other aversive events. It may be that pairing a neutral stimulus with a UEO would result in slightly different patterns of conditioning. It is important to note that the strength of the demand as an EO was indicated by the high levels of inappropriate behavior (functional analysis) and communication responses (treatment analysis and MO analysis) that were evoked when these responses were reinforced by escape from the EO. Therefore, it is likely that results for another UEO would be similar to those observed for the stimuli paired with the demand. It may be worthwhile, however, to systematically evaluate the pairing (and
subsequent unpairing) of UEOs and CEOs to empirically determine if differences exist in the conditioning processes.

Two methods were evaluated to decrease the value of the conditioned stimulus in the current investigation. Other potential methods for reducing the value of the conditioned stimulus may exist. For example, pairing a positive reinforcer with the conditioned aversive stimulus may reduce the value of the conditioned aversive stimulus. Conversely, such a procedure may result in conditioning in the opposite manner and the positive reinforcer might acquire the value of the aversive event. Future research may evaluate this or other potential methods for reducing the value of a conditioned aversive event.

It is possible that two potential processes were involved during the pairing of stimuli in the current investigation. An operant relation between the two stimuli was programmed as the responses in the presence of the CEO-R resulted in avoidance of the EO during the pairing condition. It is possible, however, that the conditioned stimulus also acquired value in a respondent manner. The stimulus may have been paired not only with the aversive event and the removal of the event, but also with any physiological changes that were associated with the aversive event. This may be more likely to occur when the aversive events are unconditioned (e.g., painful stimuli such as shocks) rather than conditioned stimuli (e.g., demands) as the former may be more likely to elicit respondent behaviors.
Limitations

There are several limitations in the current investigation that should be noted. First, there was a lack of within participant replications of the unpairing conditions for some of the participants and there was a lack of across participant replication of the natural CEO-R analysis. Although the order of conditions was counterbalanced across participants, direct replications within participants were demonstrated for only 2 of the 4 participants (Shawn and Moe). This limitation was mitigated by (a) similar patterns of responding for each pairing condition across participants regardless of whether this condition was evaluated before or following another unpairing method and (b) the successful within participant replications for the 2 students.

Another limitation is related to the permanency of the abolishing effects of unpairing. Whether or not the NCR unpairing conditions resulted in permanent alteration in the value of the CEO-R in the current investigation is not known. In order to determine if the AO produced a durable change in the value of the stimulus, it would be necessary to present the CEO-R to each participant several weeks (or months) after unpairing. Participant availability and time constraints precluded doing so. Results do indicate, however, that a stimulus can be reestablished as a CEO-R quickly if the stimuli are subsequently paired again. This was shown during reversals to pairing conditions for all 4 participants. In these phases, the conditioned stimulus and the EO were paired again, and the value of the stimulus returned and again began to evoke responses as a CEO-R.

Conditions were contrived to establish a neutral stimulus as a conditioned stimulus to function as a CEO-R. These procedures were used in order to systematically
evaluate specific pairing and unpairing conditions and the effects of these conditions on responses evoked by the aversive stimulus and the conditioned stimulus. The contrived pairing condition resulted in pairing of the neutral stimulus and the aversive stimulus on an FR1 schedule. Despite the benefits of this control, the generalizability of the current results to other, naturally occurring conditioned aversive stimuli is unclear. It remains to be determined if the pairing of a neutral stimulus in the natural environment would occur in a similar manner with respect to number of pairings required if, for example, the pairing occurred on an intermittent schedule. It is also unclear how this intermittent pairing may affect the subsequent unpairing of these events. Similarly, unpairing stimuli on a less consistent schedule is also likely to influence the efficiency of the unpairing in unknown ways. Future research should address the pairing and unpairing of stimuli in a more naturalistic manner.

Finally, the frequency of communication responses in the presence of the EO (demand) and the CEO-R (timer) were the main dependent variables in the current investigation. These dependent variables were essentially a measure of the strength of these EOs respectively. Another potential measure of the strength of an EO would be the latency from the onset of the EO to the response to escape the EO. Latency data were not collected in the current investigation, and future research may benefit from using this potentially more sensitive measure of EO strength during assessments involving EOs and AOs.
REFERENCES


APPENDICES

APPENDIX A

DIAGRAM OF PROCEDURES
Functional Analysis (Escape)

FCT Training

Treatment Analysis (FCT)

Pairing Procedure

Unpairing Procedure 1

Unpairing Procedure 2
APPENDIX B

ENDORSEMENT LETTERS, LETTERS TO PARENTS, AND CONSENT LETTERS
26 November 2007

Members of The Ohio State University Institutional Review Board,

I am writing this letter to indicate that the project "A comparison of two unpairing procedures for weakening a conditioned reflexive establishing operation for problem behavior" has the full support of Franklin County Board of Mental Retardation and Developmental Disabilities.

Our schools serve students with severe to profound developmental disabilities, many of who have difficulty learning new skills. We believe that any examination of methods for teaching new skills is appropriate for this population and believe that this project will benefit our students.

I am looking forward to collaborating with Dr. Nancy A. Neef on this project, which I believe will greatly assist us in meeting the needs of the students who receive services in our schools. When ethical clearance is obtained from your IRB, I will assist with recruitment by having our teachers send out the Consent Forms to families. Thank you.

Sincerely,

Jack Brownley
Director of Schools
Franklin County Board of Mental Retardation and Developmental Disabilities
Hi! My name is Tracy Kettering and I am a doctoral candidate in Special Education at Ohio State. As part of my degree, I am required to complete a research project under the supervision of my faculty advisor, Dr. Nancy A. Neef, a professor in the College of Education and Human Ecology. I am giving this letter to you to explain the purpose of my study and to ask permission for your child to participate.

My study is designed to reduce problem behavior that happens when demands are presented to children. If we identify that your child’s problem behavior occurs when they are given tasks to do at school, we will teach your child a different way to ask for a break from work. I then want to study things in the classroom that may make those behaviors occur more or less. For example, your child will be taught to ask for a break when given work. Then I will make a timer go off before each time I give him work to see if the timer will make the child ask for a break before the work comes. Then finally, I will then compare two ways to decrease the control that the timer has.

At the end of this study, I will meet with you to review your child’s progress and inform you of any strategies that may help decrease your child’s problem behavior at school and at home.

Your child would be involved in sessions, three to five days a week for approximately 12 weeks. Sessions would occur at your child’s school. You do not have to grant permission for your child to participate in this study, and there will be no consequences for you or your child if you choose not to participate. If your child does participate, you have the right to withdraw him/her from the study at any time without prejudice to you or your child. During any session, if your child asks to stop or shows signs of wanting to stop (beyond what might be expected in any routine teaching situation) the session will be terminated. Please be assured that you child’s name will not be revealed in any publication, document, recording, computer storage, or any other form of report or presentation developed from this research.

Attached are two copies of the research consent form. By signing this consent form you are granting permission for you child to participate in this research project. You should return a signed copy of the form and keep the second copy for your records. Please return forms by January 15, 2008.

If you have any questions regarding this research or your rights related to participation in this research, please feel free to call me at (404) 428-3486, or call Dr. Nancy Neef at (614) 688-8107 or Dr. Helen Malone at (614) 286-4515. If you have questions about your son’s/daughter’s rights as a research participant, you can call the Office of Research Risks and Protection at (614) 688-4792. Thank you for your cooperation.
Consent for Participation in Research

Protocol #

I, _________________________________________, give consent to participate in research entitled: A comparison of procedures for unpairing conditioned reflexive establishing operations being conducted by Nancy A. Neef, Ph.D., Principal Investigator, and her authorized representatives, Tracy L. Kettering, M.S., BCBA and Dr. Helen I. Malone, Ph.D. The intention of this study is in fulfillment of course requirements of a Doctoral degree program at The Ohio State University.

I have been informed that experimenters may run teaching sessions in my classroom that focus on helping my students learn to communicate. I will be asked several questions at the conclusion of the study that assess how I felt about the procedures used and their effectiveness. Possible benefits of the study have been described, as have alternative procedures, if such procedures are applicable and available. I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that I am free to withdraw consent at any time and to discontinue participation in the study without myself or my child.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me. If any further questions arise I may contact the researcher at (404) 428-3486 to gain additional information. If I have questions about my rights as a research participant, I can call the Office of Research Risks Protection at (614) 688-4792.

_________________________________________  ____________________________
(Person authorized to consent for participant)  (Date)

_________________________________________  ____________________________
(Principle Investigator or representative)  (Date)

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(Witness)
APPENDIX C

DATA SHEETS FOR RECORDING TARGET BEHAVIORS
# Data Sheet for Recording Behavior during Functional Communication Training

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Data Sheet for Recording Behavior during the MO Analysis

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<tr>
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<td>EO FCT</td>
<td>CI FCT</td>
<td>O FCT</td>
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</table>
Data Sheet for Recording Behavior during Direct Observations

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Antecedent</th>
<th>Description of situation</th>
<th>Frequency</th>
<th>Consequence</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td>1 2 3 4 5 6 7</td>
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<td>1 2 3 4 5 6 7</td>
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<td>1 2 3 4 5 6 7</td>
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<td>1 2 3 4 5 6 7</td>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

Antecedent Codes

1 – presented with instructions or tasks
2 – wants something and can’t have it
3 – an object/food item is taken away
4 – during/after attention for other behaviors
5 – change of activities (explain)
6 – awakened from night sleep/nap
7 – other (explain)

Consequence Codes

1 – ignore
2 – verbal attention (e.g., say something)
3 – time out/other punishment (explain)
4 – escape (e.g., stop making him do a task or work)
5 – physical attention (e.g., massage)
6 -- access to tangibles
7 – other (explain)
APPENDIX D

INTEROBSERVER AGREEMENT AND PROCEDURAL INTEGRITY TABLES
Table 1. Interobserver agreement during the functional analysis

<table>
<thead>
<tr>
<th></th>
<th>Inappropriate Behavior</th>
<th>Communication</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Percent of Sessions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Range</td>
</tr>
<tr>
<td>Moe</td>
<td>34.1</td>
<td>99.8</td>
</tr>
<tr>
<td>Dee</td>
<td>40.0</td>
<td>99.9</td>
</tr>
<tr>
<td>Shawn</td>
<td>33.3</td>
<td>99.4</td>
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<tr>
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<td>98.4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate Behavior</td>
<td>Communication</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Percent of Sessions</td>
<td>M</td>
</tr>
<tr>
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<tr>
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<td>Shawn</td>
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Table 2. Interobserver agreement during the FCT training
<table>
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<th>Inappropriate Behavior</th>
<th></th>
<th>Communication</th>
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</thead>
<tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td>Moe</td>
<td>30.7</td>
<td>99.4</td>
<td>91.5 – 100</td>
<td>93.9</td>
</tr>
<tr>
<td>Dee</td>
<td>30.0</td>
<td>100</td>
<td>100 – 100</td>
<td>97.0</td>
</tr>
<tr>
<td>Faye</td>
<td>33.3</td>
<td>98.2</td>
<td>90.8 – 100</td>
<td>94.46</td>
</tr>
<tr>
<td>Shawn</td>
<td>33.3</td>
<td>97.7</td>
<td>95.8 – 100</td>
<td>98.9</td>
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Table 3. Interobserver agreement during the treatment analysis
### Table 4. Interobserver agreement during the stimulus neutrality analysis

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<td>100</td>
<td>100 – 100</td>
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<tr>
<td>Dee</td>
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<td>100</td>
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<td>100</td>
</tr>
<tr>
<td>Shawn</td>
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<td>100</td>
<td>100 – 100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Inappropriate Behavior</td>
<td>Communication</td>
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</tr>
<tr>
<td></td>
<td>Percent of Sessions</td>
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<td>Range</td>
<td>M</td>
</tr>
<tr>
<td>Moe</td>
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<td>90.0 – 100</td>
<td>90.1</td>
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<tr>
<td>Dee</td>
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<td>82.3 – 100</td>
<td>96.2</td>
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<td>Faye</td>
<td>37.7</td>
<td>93.8</td>
<td>75.0 – 100</td>
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<td>Shawn</td>
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<td>88.8 – 100</td>
<td>99.8</td>
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</table>

Table 5. Interobserver agreement during the MO Analysis
Table 6. Procedural integrity during the FCT and MO analyses for each Participant

<table>
<thead>
<tr>
<th></th>
<th>Percent of Sessions</th>
<th>M</th>
<th>Range</th>
<th>Percent of Sessions</th>
<th>M</th>
<th>Range</th>
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</thead>
<tbody>
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<tr>
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<td>97.0 – 100</td>
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<td>97.0 – 100</td>
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<tr>
<td>Dee</td>
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<td>98.4 – 100</td>
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<tr>
<td>Shawn</td>
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<td>100</td>
<td>100 – 100</td>
<td>33.3</td>
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<td>100 – 100</td>
</tr>
</tbody>
</table>

Table 6. Procedural integrity during the FCT and MO analyses for each Participant
APPENDIX E

DATA SHEETS FOR COLLECTING PROCEDURAL INTEGRITY
Procedural Integrity Checklist for Functional Communication Training

Rules for Treatment Integrity Collection

1. Mark “yes” or “no” for each applicable item on the sheet.
2. For items with more than one space, put a “+” or “-” sign in each box that the opportunity was present: a “+” sign represents that the opportunity was implemented correctly and a “-” represents that the opportunity was not implemented correctly.

<p>| | | | | | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A demand is presented at the beginning of each trial.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Within 5 s of the demand, a prompt for the alternative communication response is initiated.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>The prompt level for the FCT response is the appropriate level (i.e., physical, model, verbal, delayed verbal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.</td>
<td>Contingent on the FCT responses (prompted or unprompted), the task demands are removed for 30 s.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5.</td>
<td>No consequences are presented for the occurrence of problem behavior.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>6.</td>
<td>10 training trials are completed</td>
<td>yes</td>
<td>no</td>
<td></td>
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Procedural Integrity Checklist for Pairing Condition

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<tbody>
<tr>
<td>1</td>
<td>Timer is presented on an FT 50 s schedule for 10 s</td>
</tr>
<tr>
<td>2</td>
<td>Correct prompting procedure is implemented for each demand (least-to-most prompting).</td>
</tr>
<tr>
<td>3</td>
<td>A 10 s ITI is initiated following completion of the demand</td>
</tr>
<tr>
<td>4</td>
<td>Contingent on the appropriate communicative responses in the presence of the timer, the timer is removed and the demand is not presented at the end of the timer interval</td>
</tr>
<tr>
<td>5</td>
<td>Contingent on the appropriate communicative responses in the presence of the demand, the task demand is removed until the next FT 50 s schedule.</td>
</tr>
<tr>
<td>6</td>
<td>No consequences are presented for the occurrence of problem behavior.</td>
</tr>
<tr>
<td>7</td>
<td>Session is 10 minutes in length.</td>
</tr>
</tbody>
</table>

Rules for Treatment Integrity Collection

1. Mark “yes” or “no” for each applicable item on the sheet.
2. For items with more than one space, put a “+” or “-” sign in each box that the opportunity was present: a “+” sign represents that the opportunity was implemented correctly and a “-” represents that the opportunity was not implemented correctly.
Procedural Integrity Checklist for Extinction Type Unpairing

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Timer is presented on an FT 50 s schedule for 10 s</td>
</tr>
<tr>
<td>2.</td>
<td>Correct prompting procedure is implemented for each demand (least-to-most prompting).</td>
</tr>
<tr>
<td>3.</td>
<td>A 10 s ITI is initiated following completion of the demand</td>
</tr>
<tr>
<td>4.</td>
<td>Contingent on the appropriate communicative responses in the presence of the timer, the timer is removed and the demand is presented at the end of the 10 s interval</td>
</tr>
<tr>
<td>5.</td>
<td>Contingent on the appropriate communicative responses in the presence of the demand, the task demand is removed until the next FT 50 s schedule.</td>
</tr>
<tr>
<td>6.</td>
<td>No consequences are presented for the occurrence of problem behavior.</td>
</tr>
<tr>
<td>7.</td>
<td>Session is 10 minutes in length.</td>
</tr>
</tbody>
</table>

Rules for Treatment Integrity Collection

1. Mark “yes” or “no” for each applicable item on the sheet.
2. For items with more than one space, put a “+” or “-” sign in each box that the opportunity was present: a “+” sign represents that the opportunity was implemented correctly and a “-” represents that the opportunity was not implemented correctly.
### Procedural Integrity Checklist for NCR Unpairing

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<tbody>
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<td>1. Mark “yes” or “no” for each applicable item on the sheet.</td>
</tr>
<tr>
<td></td>
<td>2. For items with more than one space, put a “+” or “-” sign in each box that the opportunity was present: a “+” sign represents that the opportunity was implemented correctly and a “-” represents that the opportunity was not implemented correctly</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Timer is presented on an FT 50 s schedule for 10 s</td>
</tr>
<tr>
<td>2.</td>
<td>The demand is not presented at the end of the 10 s timer interval.</td>
</tr>
<tr>
<td>3.</td>
<td>A 40 s ITI is initiated following the timer interval.</td>
</tr>
<tr>
<td>4.</td>
<td>Contingent on the appropriate communicative responses in the presence of the timer, the timer remains present.</td>
</tr>
<tr>
<td>5.</td>
<td>Appropriate communication responses in the presence of the ITI are ignored.</td>
</tr>
<tr>
<td>6.</td>
<td>No consequences are presented for the occurrence of problem behavior.</td>
</tr>
<tr>
<td>7.</td>
<td>Session is 10 minutes in length.</td>
</tr>
</tbody>
</table>

**Rules for Treatment Integrity Collection**

1. Mark “yes” or “no” for each applicable item on the sheet.
2. For items with more than one space, put a “+” or “-” sign in each box that the opportunity was present: a “+” sign represents that the opportunity was implemented correctly and a “-” represents that the opportunity was not implemented correctly.
APPENDIX F

SOCIAL VALIDITY QUESTIONNAIRE
Social Validity Questionnaire

A Comparison of Unpairing Procedures for Conditioned Reflexive Establishing Operations

1. How satisfied were you with the treatment initiated with your student/child in the current study?
   
   Not satisfied 1 2 3 4 5 6 7  
   Very satisfied  

2. How frequently did your student/child engage in problem behavior prior to the initiation of the study?

   Not at all 1 2 3 4 5 6 7  
   Very frequently  

3. How frequently does your student/child engage in problem behavior now that the study has been completed?

   Not at all 1 2 3 4 5 6 7  
   Very frequently  

4. Do you feel that the time required to complete the study was justified in terms of what your child gained from completing the study?

   Not justified 1 2 3 4 5 6 7  
   Very justified  

5. Would you let your student/child participate in a similar study in the future?
   Yes     No  

6. Would you recommend other parents/teachers to allow their children to participate in a similar study in the future?
   Yes     No  

7. Any additional comments/feedback?

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