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GENERALIZATION OF NEGATIVELY REINFORCED MANDS IN CHILDREN WITH DEVELOPMENTAL DISABILITIES

by

Nicole C. Groskreutz

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

of

DOCTOR OF PHILOSOPHY

in

Disability Disciplines

Approved:

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UTAH STATE UNIVERSITY
Logan, Utah

2012

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ABSTRACT

Generalization of Negatively Reinforced Mands in Children with Developmental Disabilities

by

Nicole C. Groskreutz, Doctor of Philosophy

Utah State University, 2012

Major Professors: Dr. Timothy A. Slocum & Dr. Sarah E. Bloom
Department: Special Education and Rehabilitation

Everyone, including children with developmental disabilities, encounters stimuli they find aversive every day (e.g., the sound of a classmate tapping their pencil). These aversive stimuli may not be problematic for typically developing individuals, because they learn to behave in ways that allow them to escape or avoid this aversive stimulation. They could, for example, mand (i.e., request) for something to be changed in the environment (e.g., ask their classmates to stop tapping their pencils). A child with developmental disabilities, however, may not have the communication skills necessary to request the termination of aversive stimuli, which may result in frequent exposure to aversive situations. For these children, it may be useful to acquire a general mand (e.g., saying, "No, thank you") which could be used to avoid or terminate a variety of aversive stimuli. Previous researchers teaching mands for negative reinforcement have focused on replacing problem behavior maintained by escape from task demands. The current study extended the literature on teaching mands for negative reinforcement by teaching children with developmental disabilities to mand for escape from a variety of nonpreferred stimuli, while assessing generalization to untrained stimuli and settings. Participants were two school-aged boys with autism who engaged in problem behavior when they encountered nonpreferred stimuli, and did not use an appropriate mand for negative reinforcement. First, we employed a non-preferred stimulus assessment to identify stimuli for subsequent use in mand training. Next, we conducted mand training sequentially across nonpreferred stimuli until sufficient exemplars were trained for generalization to untrained stimuli to occur. Finally, we conducted probes to assess generalization of the mand response to nontraining contexts outside of the experimental setting. For both participants, training was required across two stimuli before cross-stimulus generalization was observed. Because generalization did not bring the mand to criterion levels with the third stimulus, for either participant, training was introduced to facilitate acquisition. The mand response was acquired with a fourth stimulus in the absence of training. Through the inclusion of appropriate control conditions, we showed that the stimulus control of the mand response was appropriate, occurring almost exclusively in the presence of nonpreferred stimuli. In addition, we showed decreases in problem behavior, for both participants, which corresponded to acquisition of the mand response. We also provided evidence of generalization to nontraining contexts. We discuss limitations of the current study and present suggestions for future research.

(141 pages)

PUBLIC ABSTRACT

Generalization of Negatively Reinforced Mands in Children with Developmental Disabilities

Nicole Groskreutz

Nicole Groskreutz along with her advisors, Dr. Timothy Slocum and Dr. Sarah Bloom, from the Department of Special Education and Rehabilitation at Utah State University, proposed to teach children with developmental disabilities to appropriately request the termination of things they do not like, in place of engaging in problem behavior. The researchers collaborated with educators and administrators in public and/or private schools to identify students in need of this skill and to carry out all experimental phases. The researchers have significant clinical and research experience in teaching communication skills and decreasing problem behavior in individuals with developmental disabilities.

The researchers proposed to teach two to six preschool or elementary-aged children an appropriate request (e.g., signing “stop”) to terminate a variety of nonpreferred items or activities (e.g., an alarm clock sounding, a vacuum cleaner running). We first interviewed teachers and caregivers and conducted classroom observations to identify potential nonpreferred items and activities that precede problem behavior (e.g., ear covering, crying, self-injurious behavior). Targeted training stimuli (i.e., the items or activities) were then identified through a formal assessment. Appropriate requests were then taught in the presence of the specific stimuli identified as nonpreferred through the formal assessment. Training was conducted in the presence of multiple stimuli, until either generalization to untrained target stimuli occurs, or the response is trained in the presence of all targeted stimuli. Generalizations to non-experimental settings were also assessed.

The results were expected to demonstrate that participants require training in the presence of multiple stimuli before generalization to untrained stimuli occurs. In addition, generalization to non-experimental settings is hoped for, but not certain. If it did not occur within the context of

the experimental training procedures, researchers will then collaborate with educators to facilitate transfer of the appropriate request to appropriate situations across settings. It was expected that participants would benefit from this research, acquiring a new response to terminate multiple non-preferred activities and stimuli. In addition, the benefits of this research extend beyond the participants involved, contributing to the development of effective procedures to teach requests for the termination of nonpreferred items or activities (i.e., mands for negative reinforcement) to any individual who does not demonstrate this skill.

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I would like to extend my sincerest appreciation and gratitude to Timothy Slocum, my major professor. Your guidance and support on this project has made it come to fruition. In addition, throughout my graduate studies, you were forever a kind, encouraging advisor, brilliant behavior analyst, and phenomenal teacher – always challenging me to be my best. For that I cannot thank you enough. I would also like to extend my sincerest appreciation and gratitude to Sarah Bloom, my co-advisor on this project. In particular, Sarah, you were invaluable to me in the conceptualization and writing of this study, and I benefited immensely from your expertise in data analysis and research methodology. Without both of you, this project would not have been completed. I would also like to thank each of my committee members, Robert Morgan, Timothy Shahan, Thomas Higbee, and Amy Odum. Your procedural and conceptual guidance has been invaluable in the development of this project.

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I will be forever grateful.

Nicole Groskreutz

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CHAPTER I

INTRODUCTION

Everyone, including children with developmental disabilities, encounters stimuli that are aversive in their daily lives. For example, the sound of an alarm clock, the smell of the trash, and the brightness of the sun in someone's eyes are all stimuli that bother most people to some extent. Encountering things that are mildly aversive is not usually problematic for typically developing individuals, because people learn various ways to manipulate the environment to avoid or escape those stimuli they find aversive: They can turn off their alarm clocks, take out the trash, and put sunglasses on when they go outside. Other types of aversive stimuli require people to interact with others to change them. For example, if a woman finds it mildly aversive when she is working in her office and a chatty co-worker comes by and stays for a while, she can politely ask her co-worker to come by at a later time. Or, when a man goes to look for a new car to buy, he may encounter an overzealous salesman who follows him around talking about the cars they pass by. To remove these noxious stimuli, the man could say something like, "Thank you, but I'm just looking. I'll let you know if I need something," thereby reducing the aversiveness of the situation.

Children at school may encounter events they find aversive. They can directly affect some of those events by changing something in their environment (e.g., wiping the glue off their hands after completing an art project if the stickiness is unpleasant); but many other stimuli are unchangeable without interacting with others. For example, if a boy finds it aversive that his classmate is tapping a pencil during a test he could ask his classmate to stop. If a girl found the smell in the cafeteria to be aversive perhaps she could request to eat in her classroom. Children in school have far less freedom than adults to act directly to change events in their environment. While not every request is reinforced, it is important for children to have effective ways to communicate to get their needs met. On a broader scope, across *all* social environments, there are advantages associated with being able to let others know when something is aversive, so that life can be made more enjoyable each day.

Some children with developmental disabilities do not have the skills required to terminate aversive situations in a socially appropriate manner. If they are not able to request for something to stop, children with disabilities are vulnerable, because they may be subjected to stimuli that could be harmful, without an appropriate way to terminate them. For example, if a boy with developmental disabilities were to start screaming and punching his stomach while sitting at his desk during math class, the teacher might think that the math assignment was too difficult for the boy and the behavior was an attempt to escape from the assigned work. However, perhaps the boy's screaming and self-injury was occurring because he had appendicitis. Without an appropriate way to say, "Help me, it hurts", it may take a very long time for someone to realize that the boy was experiencing physical discomfort. Lack of an appropriate response to a situation such as this could result in serious injury for a student with disabilities. In a less extreme example, a child could be physically harmed, over time, by consistent exposure to mildly aversive stimuli, such as loud noises. Consistent exposure to loud noises could cause ear damage to a child (e.g., Maassen et al., 2001). Having a way to request that something stops is a necessary safety skill.

Beyond being a safety skill, acquisition of a termination request could make children's lives more pleasant, since they would, potentially, be able to limit their exposure to situations they did not prefer. This would increase their autonomy and independence, because they would no longer have to rely on someone else "figuring out" that something might be bothering them, what that something is, and then do something about it. If children with disabilities do not have the skills to terminate aversive situations, they may be exposed to numerous aversive stimuli and this exposure may continue for longer periods of time. For example, children with developmental disabilities could be presented with leisure items they do not prefer, be asked to sit in an area that is too loud for them, or have to listen to someone sing a song that they do not like. Without an effective, appropriate way to communicate (e.g., saying “No, thank you”), these children could develop problem behavior in an attempt to terminate aversive situations (e.g., throwing the non-preferred leisure item, bolting from the area that is too loud, or hitting the individual who is singing the song they do not like). If children with disabilities are taught socially appropriate ways to terminate aversive situations, it could prevent problem behaviors from developing.

Even if more severe problem behaviors do not develop, individuals with disabilities could learn to escape situations they find somewhat aversive by engaging in behaviors like pushing items away and covering their ears. Although these behaviors are more socially acceptable than aggressive or disruptive behaviors, they may limit an individual’s opportunity to engage with instruction. For example, if a child is given finger paints and pushes them away, the teacher may take that to mean that the child is unwilling to paint. Perhaps, however, the child enjoys painting, but would prefer to use a brush. If the child instead says, “Something different, please” or “No finger paints, please” the teacher may be less likely to remove the activity all together, instead modifying the activity to make it more enjoyable for the individual with disabilities. In another example, if a girl is covering her ears during a lesson and is thus unable to hear the teacher, it would be quite difficult for her to benefit from instruction. If she learns a more appropriate way to request termination of something in the environment (e.g., the sound of a fan), she will no longer need to engage in a behavior that helps to eliminate the stimulus she finds aversive (i.e., cover her ears), allowing the opportunity to benefit from instruction.

Certainly not every aversive situation can or should be terminated, even when an appropriate request is made. There are situations, even if aversive, that children need to tolerate. For example, all children should get their teeth cleaned at the dentist, take medications when needed, wear warm clothing when going outside in cold temperatures, and participate in academic tasks throughout the school day. Even when children with developmental disabilities have learned appropriate requests to terminate aversive situations, there will continue to be events, such as those just described, which cannot or should not be terminated. It is therefore important for children to learn the necessary discriminations to accompany requests for termination of aversive events; there are situations in which the requests will be reinforced, and there are other situations in which they will not be. When children do not have appropriate responses to terminate aversive situations in their repertoires, it may seem safer not to train a response which could then be overused. However, it is important to teach the appropriate request and the necessary discriminations. Failing to teach an appropriate request would likely result in the continued occurrence of problem behaviors, as children would continue to have no appropriate means of getting their needs met.

For children who do not yet display any means of requesting termination of stimuli they find aversive, a beneficial first step may be to teach a general response, such as "No, thank you", which could be used in numerous aversive situations. The current study will focus on teaching this general response across multiple stimuli, so that it occurs in appropriate situations. For example, a child who communicates through the exchange of picture cards could learn to hand over a card that says, "No, thank you" during several situations they find aversive (e.g., when presented with leisure items they do not prefer, when prompted to sit in an area that is too loud for them, or when someone begins singing a song that they do not like). Following an assessment to identify which aversive situations to target, training could occur across those situations. Once the child has learned an appropriate way to communicate that he/she would like something to stop, it is possible that the response would generalize to other situations, including those that are more dangerous.

Teaching a generalized response which can be used across aversive situations is an important first step for individuals who do not have any appropriate means of terminating aversive events. However, this must be recognized as only a first step towards teaching children to produce specific requests to escape specific stimuli. Teaching specific requests would require, for example, that rather than teaching "stop" in the presence of a non-preferred song and a work task that is too hard, an individual is taught to say "Please stop the music" and "I would like a break, please". These specific requests are, perhaps, more likely to be reinforced, as the additional words more clearly specify what the individual would like stopped. However, when an individual has no appropriate way to terminate aversive situations, it may be best to begin with training a general response that can be reinforced across stimuli.

Children with developmental disabilities often require training to learn socially appropriate ways to influence their environment. One way that children can influence their environment, increasing control over what goes on around them, is to learn to mand either for access to things they prefer, or for the removal of things they find aversive. As defined by Skinner (1957), a mand is "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (p.35-36). Stated in everyday terms, a mand is a request. When a boy requests something desired, such as a cookie (e.g., saying, "I want a cookie"), the mand is positively reinforced when he is given a cookie. When a girl requests that something non-preferred, like the sound of an alarm, be removed, (e.g., saying, "Turn off the alarm, please,") the mand is negatively reinforced when the alarm is shut off. The mand training literature has focused primarily on teaching mands for positive reinforcement (e.g., Hartman & Klatt, 2005; Marckel, Neef, & Ferreri, 2006), and the negative reinforcement functional communication training literature has focused on training mands for escape from task demands (e.g., Durand & Carr, 1991). Only a few studies have examined procedures to teach mands for negative reinforcement, other than escape from task demands, or investigated generalization of trained mands to untrained stimuli.

CHAPTER II

LITERATURE REVIEW

Negative Reinforcement

Negative reinforcement is one of the elementary principles of behavior (Skinner, 1953). It describes the contingent removal, reduction, termination, or postponement of stimulation following a response, which results in an increase in the future probability of occurrence of that response (Cooper, Heron, & Heward, 2007). Negative reinforcement can take the form of interruption of on-going stimulation (i.e., escape), or postponement of stimulation that has not yet occurred (i.e., avoidance; Skinner, 1953). It is critical to the development of many appropriate and valuable behaviors, such as removing one's hand from a hot stove. It is through negative reinforcement that individuals learn to behave in ways that reduce their exposure to unpleasant experiences. For example, if it is negatively reinforcing to escape the feeling of being cold, an individual will learn to engage in behaviors such as putting on additional layers of clothing or going someplace where it is warmer. Negative reinforcement enables an individual to learn to behave in ways such that they protect themselves from hypothermia and other ill effects of exposure to the cold. Negative reinforcement also, however, contributes to the development of many inappropriate and problematic behaviors (Iwata, 1987).

Early assessment and treatment research provided evidence that problem behavior could be maintained by negative reinforcement, by demonstrating either a relation between presentation of demands and problem behavior (Carr, Newsom, & Binkoff, 1980), or between increasing task difficulty and increases in problem behavior (Carr & Durand, 1985; Sailor, Guess, Rutherford, & Baer, 1968; Weeks & Gaylord-Ross, 1981). With the development of functional analysis methodology (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), a functional relation between problem behavior and negative reinforcement could be empirically demonstrated and differentiated from alternative sources of reinforcement. Functional analysis procedures allow for the identification of both social (i.e., involving another person in the environment) and automatic (i.e., not involving another person) sources of reinforcement. Standard functional analysis conditions test for behavioral sensitivity to social positive reinforcement (i.e., attention or tangible items), social negative reinforcement (i.e., escape from task demands), and automatic reinforcement (e.g., sensory stimulation or pain attenuation). If the rate of problem behavior is elevated in the test condition for social negative reinforcement, relative to the rate of problem behavior in a control condition, escape from demands is identified as a function for problem behavior.

In the decades since Iwata et al. (1982/1994) first developed functional analysis methodology, the procedures have been successfully replicated and extended across a variety of client populations and topographies of problem behavior (Hanley, Iwata, & McCord, 2003), with tests for social negative reinforcement continually included in the analyses. Two reviews of functional analysis procedures and outcomes have examined the relative frequency of the various possible functions of problem behavior (Iwata et al., 1994; Hanley et al., 2003). Iwata et al. (1994) conducted an experimental-epidemiological analysis, summarizing 152 single-subject analyses of the reinforcing functions of self-injurious behavior (SIB), and found that social negative reinforcement accounted for the largest proportion of SIB. Social negative reinforcement was the identified function of SIB in 58 of 152, or 38.1% of cases. In a more recent literature review, Hanley et al. (2003) analyzed 536 individual data sets from functional analyses, and found that 176 data sets, or 34.2%, showed that the problem behavior was maintained through negative reinforcement. This was a meaningful proportion of the data sets, with social positive reinforcement being only slightly more common at 35.4%. Together the evidence from these reviews indicates that social negative reinforcement is a common function for self-injurious behavior, and other topographies of severe problem behavior.

The majority of research conducted on problem behavior maintained by social-negative reinforcement has used task demands as the aversive stimulus (Hanley et al., 2003). In fact, Iwata et al. (1994) found that social negative reinforcement was assessed in the form of escape from task demands in 93% of cases (54 of 58) in which social negative reinforcement was identified as the function for SIB. However, some research has been conducted in which various aspects of the demand context have been manipulated to identify which properties are influencing occurrence of problem behavior (e.g., Smith, Iwata, Goh, & Shore, 1995). Manipulations have been made to task novelty, the duration of instructional sessions, the rate of task presentation (Smith et al., 1995), the level of task difficulty, the level of teacher attention (Moore & Edwards, 2003), the presence of a specific instructional strategy, the choice of the sequence of completion of instructional tasks, and repetition versus variation of instruction (McComas, Hoch, Paone, & El-Roy, 2000). These manipulations have illustrated that even when problem behavior is identified as escape-maintained in the presence of demands, it can be functionally related to differing aspects of the demand context. Identification of the specific aspects of the demand context associated with problem behavior may then result in development of more effective treatment. When it can be determined what, specifically, is aversive (e.g., the pace of instruction is too fast, or there is not enough variation in instruction), the appropriate manipulations can be made to those tasks to decrease their aversiveness (e.g., slowing down the pace of instruction, or introducing greater variation in instruction).

Additional research has been conducted illustrating the complexity of the functional relation between problem behavior and escape from demands. O'Reilly, Lacey, and Lancioni (2000) conducted a series of studies demonstrating that problem behavior maintained by escape from demands is also sensitive to additional variables such as noise (O'Reilly et al., 2000), sleep deprivation (O'Reilly, 1995), and conditions in the classroom prior to functional analysis sessions (O'Reilly & Carey, 1996). In addition, a limited number of studies have been conducted examining escape from stimuli other than task demands. Researchers have examined occurrence of problem behavior to escape stimuli or events such as noise or music (Buckley & Newchok, 2006; Derby et al., 1994; McCord, Iwata, Galensky, Ellingson, & Thomson, 2001; O'Reilly, 1997; Smith et al., 1995), medical examinations (Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990), and social interaction (Frea & Hughes, 1997; Vollmer et al., 1998). There are, however, very few studies documenting the relation between negatively reinforced problem behavior and different aspects of the demand context, or various classes of stimuli (e.g., loud noises). Additional research in this area could lead to improvements in assessment and treatment of problem behavior in additional contexts (Hanley et al., 2003).

Little is known about the assessment of problem behavior maintained by sources of negative reinforcement other than task demands. Aside from the handful of studies referenced above (e.g., Smith et al., 1995), there has been limited documentation of problem behavior maintained by escape from non-task related stimuli (Hanley et al., 2003). Observation of students with developmental disabilities in school classrooms, however, might suggest that there are numerous stimuli, in addition to task demands, that children encounter daily and engage in problem behavior to escape or avoid. For example, children may push art supplies onto the floor to avoid putting their hands in finger paints, flop to the floor and cover their ears to escape a loud noise such as the school bell, or hit a peer upon entering the cafeteria, so that they can be taken from the room, thus escaping the smell of lunch cooking. To adequately address problem behaviors such as these, it may be useful to develop additional technologies to identify a functional relation between various environmental stimuli and problem behavior hypothesized to be negatively reinforced. Subsequent interventions might then be developed, informed by the results of the assessment, allowing the clinician to target the specific source of negative reinforcement maintaining the problem behavior.

Nonpreferred Stimulus Assessments

When developing positive-reinforcement-based interventions, it can be useful to identify stimuli to use as reinforcers. These stimuli could, for example, be delivered contingent upon the occurrence of a behavior targeted for increase, or contingent upon the absence of a behavior targeted for decrease. Identification of reinforcers typically has begun with an assessment to identify preferred stimuli, followed by an assessment to determine whether the preferred stimuli also function as reinforcers. Researchers have conducted a number of studies on the development of systematic assessment procedures to identify preferred stimuli for individuals with developmental disabilities (see Hagopian, Long, & Rush, 2004, for a review). Preference assessment procedures have often employed a single measure of interaction with stimuli, either approach or engagement, to suggest a preference for those stimuli. Approach responses have typically been defined as reaching for or touching an item, and have been measured when stimuli are presented individually (e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985), in pairs (e.g. Fisher et al., 1992), or when multiple stimuli are presented simultaneously (e.g., DeLeon & Iwata, 1996). Alternatively, researchers have measured participants' engagement with stimuli using either duration (e.g., DeLeon, Iwata, Conners, & Wallace, 1999; Hagopian, Rush, Lewin, & Long, 2001), or partial interval recording (e.g., Roane, Vollmer, Ringdahl, & Marcus, 1998). Hierarchies of preferred stimuli have then been generated based on participant interaction with stimuli, using either the percentage of approach responses, or duration or percentage of intervals of engagement (e.g., Hagopian et al., 2001). These hierarchies are then used to identify stimuli to employ as positive reinforcers, made available either contingently or non-contingently, in subsequent treatments.

It is also necessary to identify stimuli to use within negative reinforcement-based or punishment-based interventions to ensure that effective reinforcers and punishers are used when attempting to change behaviors of social significance maintained by negative reinforcement, or warranting the use of punishment. However, in comparison to the literature on preferred stimulus assessments, very little research has been conducted on the methods to identify and rank order non-preferred or aversive stimuli for subsequent use in treatments. One study investigating assessment procedures to identify positive reinforcers measured avoidance responses in addition to approach responses (Green et al., 1988). Green et al. (1988) conducted a single stimulus assessment, based on the procedures of Pace et al. (1985), with individuals with profound mental retardation. Avoidance responses were defined as the participant exhibiting negative vocalizations, pushing a stimulus away, or making movements away from a stimulus (e.g., head-turning). The purpose of this assessment, however, was to identify preferred, rather than non-preferred, stimuli. Furthermore, preference was determined based solely on the basis of approach responses, even though all seven participants engaged in avoidance responses in the presence of some of the stimuli.

A few researchers have employed non-preferred stimulus assessments to identify stimuli which were then used in various ways during subsequent interventions (e.g., Buckley & Newchok, 2006; Fisher, Piazza, Bowman, Hagopian, & Langdon, 1994; Zarcone, Crosland, Fisher, Worsdell, & Herman, 1999). As an example, putative non-preferred stimuli have been assessed to identify which specific stimuli were functionally related to problem behavior. Subsequent interventions were then developed, incorporating assessment results, so that problem behavior was targeted for reduction in the presence of the specific stimuli which occasioned it (e.g., McCord et al., 2001).

Two studies investigated assessment procedures designed to identify which specific auditory stimuli evoke problem behavior (Buckley & Newchok, 2006; McCord et al., 2001). McCord et al. (2001) recorded noises (e.g., a phone ringing, a peer screaming, the fire alarm sounding) that were identified by staff as potential antecedents to problem behavior for seven participants with developmental disabilities. Each noise was then presented for a minimum of three 5-min sessions within a multi-element design. Sounds were initially presented at 65 decibels, and if problem behavior was not observed, the decibel level was increased. During a session, the noise was played continuously unless a participant engaged in problem behavior, which resulted in the tape being stopped for 30 s. Specific auditory stimuli associated with problem behavior were identified for only two of seven participants (i.e., a phone ringing and a peer stating insults). For these two participants, treatments were developed to eliminate problem behavior in the presence of the auditory stimuli. Treatment components consisted of putting problem behavior on extinction, stimulus fading (i.e., increasing the decibel level of auditory stimuli), and differential reinforcement of other behavior for one participant (i.e., reinforcing the absence of problem behavior with an edible).

Buckley and Newchok (2006) extended the assessment of auditory stimuli to the ear covering and screaming of a boy with pervasive developmental disorder. They assessed different genres of music (i.e., pop, classical, jazz, and rock) played from different sources (i.e., CD versus tape). During 5-min sessions, music was played continuously unless problem behavior occurred, which resulted in 30 s termination. Leisure materials were available during all assessment sessions, including during a control condition in which no music was played. The participant showed increased levels of problem behavior in the presence of taped music of all genres. The assessment results were used to develop treatment to eliminate problem behavior in the presence of taped music. Both of these studies (Buckley & Newchok, 2006; McCord et al., 2001) employed procedures to assess occurrence of problem behavior in the presence of various stimuli, thus identifying non-preferred stimuli in the presence of which to target reduction of problem behavior. However, these assessments included only auditory stimuli, so it remains unclear whether these procedures would be applicable to the assessment of other types of putative non-preferred stimuli (e.g., olfactory or tactile stimuli).

Non-preferred stimulus assessments could also be used to identify non-preferred stimuli which could then be employed by clinicians as tools to change behavior, as either positive punishers (e.g., Fisher et al., 1994; Zarcone et al., 1999) or negative reinforcers. When used as a positive punisher, a non-preferred stimulus is presented contingent on the occurrence of a behavior targeted for decrease (e.g., problem behavior), and if that stimulus functioned as a positive punisher, its presentation would result in a decrease in the future probability of the target behavior. For example, if a girl engaged in thumb sucking behavior to the point that it was causing tissue damage to her hand, and reinforcement procedures were ineffective in decreasing the behavior to an acceptable level, a non-preferred stimulus assessment could be conducted to determine which stimuli may decrease the occurrence of the behavior, when used as positive punishers. If, through assessment, it was determined that application of lemon juice to her thumb, for example, functioned as a positive punisher, an effective treatment could be designed incorporating the application of lemon juice contingent on the occurrence of thumb sucking, to decrease the future probability of the behavior. When used as a negative reinforcer, a non-preferred stimulus would be presented, and the occurrence of a behavior targeted for increase (e.g., a functional communication response) would result in the termination of the stimulus, and there would be an increase in the future probability of the target behavior. Thus, although the same non-preferred stimulus (e.g., a loud noise) could be used in a positive punishment procedure or in a negative reinforcement procedure, a response that produces a loud noise would decrease as a function of positive punishment, but a response which terminates the loud noise would increase as a function of negative reinforcement (Cooper et al., 2007). Assessment procedures designed to identify rank ordered non-preferred stimuli could therefore be useful in the development of both positive punishment and negative reinforcement procedures.

Three studies have been conducted on assessment procedures to identify non-preferred or aversive stimuli (Call, Pabico, & Lomas, 2009; Fisher et al., 1994; Zarcone et al., 1999). Following non-preferred or aversive stimulus assessments, Fisher et al. (1994) and Zarcone et al. (1999) validated the results in the context of identifying positive punishers for use in the treatment of problem behavior, and Call et al. (2009) validated the results using assessed stimuli as negative reinforcers during subsequent functional analyses. Based on single stimulus preference assessment procedures (Pace et al., 1985), Fisher et al. (1994) conducted an avoidance assessment on multiple procedures for subsequent use as punishers (e.g., facial screen, hands down, water mist). In this assessment, each procedure was implemented for one 10-trial session. Trial durations ranged from 15 s to 180 s to identify the most effective procedure duration. Observers recorded occurrence of (a) the participant successfully stopping the procedure (e.g.

breaking out of a basket hold), (b) negative vocalizations, (c) avoidant movements, and (d) positive vocalizations. The participant successfully stopping the procedure constituted a failure of treatment integrity, because if the participant could stop the procedure it would not be consistently implemented. An avoidance index was calculated as the rate of negative vocalizations plus avoidant movements minus positive vocalizations. A hierarchy was then generated from these indices, and the effectiveness of procedures identified as highly avoided, moderately avoided, and least avoided were compared when implemented as punishers for problem behavior. For both clients, the punisher assessment validated results of the stimulus avoidance assessment, that is, it predicted the procedure that was most effective in reducing problem behavior.

Based on the procedures developed by Fisher et al. (1994), Zarcone et al. (1999) investigated the effectiveness of assessment procedures to identify non-preferred stimuli for five children with developmental disabilities and severe destructive behavior. Each participant's parent first completed a Negative Reinforcement Rating Scale (NRRS) to identify tasks that each child may avoid. Based on the results of the NRRS, six tasks were chosen to assess for each child, ranging from potentially preferred to potentially nonpreferred. Prior to the assessment, each participant was trained to engage in a simple response (e.g., hand clapping) to access 30 s escape, using a task rated as moderately nonpreferred. Latency to the escape response was then measured during the negative reinforcer assessment. During the assessment, each stimulus was presented for one 10-min session, with the therapist presenting the task immediately and continuously, unless the escape response occurred, which resulted in 30 s of escape. For all participants, a hierarchy of nonpreferred stimuli was generated using the mean latency to the escape response in the presence of each stimulus. For one participant, the stimuli with the shortest, middle, and longest response latencies (hair brushing, remaining in seat, and doing paper and pencil tasks, respectively) were then assessed, to determine their effectiveness as positive punishers, when applied contingent on problem behavior. The task from the negative reinforcer assessment with the shortest latency to the escape response (i.e., hair brushing) produced the greatest suppression in destructive behavior, when applied contingently.

Call et al. (2009) expanded the findings of Zarcone et al. (1999), for two participants, using the results of an NRRS to identify demands for subsequent assessment. However, instead of training the participants to engage in an escape response, they measured latency to the first instance of problem behavior in the presence of each stimulus. Three complete series were conducted, with sessions lasting a maximum of 10 min (although they were often shorter, because they ended after the first occurrence of problem behavior). Following the demand assessment, a functional analysis was conducted, including two types of demand conditions: highly aversive, in which the item with the shortest mean latency to problem behavior from the prior assessment was used, and less aversive, in which the item with the longest mean latency was used. For both participants, the demand assessment produced a hierarchy of demand aversiveness, with subsequent functional analyses confirming the predictive value of the hierarchy; highly aversive demands produced higher rates of problem behavior than less aversive demands. The demand assessment results, however, were only confirmed at the level of comparing the demands with the shortest and longest latencies, when there were 10 putative non-preferred demands assessed for each participant.

Call et al. (2009), Fisher et al. (1994), and Zarcone et al. (1999) all used assessment procedures to evaluate the aversiveness of individual stimuli, thus producing hierarchies of non-preferred stimuli. In addition, Fisher et al. (1994) and Zarcone et al. (1999) then used stimuli identified as least preferred as components of treatment packages to reduce problem behavior. There are several ways, however, in which these studies could be extended to further the assessment of non-preferred stimuli. First, although Call et al. (2009) confirmed the predictive value of the demand assessment through subsequent functional analyses, the study did not include an evaluation of treatments designed using these assessment results. Second, stimuli assessed by Fisher et al. (1994) were limited to procedures intended to punish problem behaviors (e.g., contingent demands, contingent exercise, hands down, chair timeout), and Zarcone et al. (1999) and Call et al. (2009) limited their assessment to various demands (e.g., tracing letters, wiping the table, transitioning, remaining in seat). It is unclear whether these procedures would be effective in generating hierarchies with other non-preferred stimulus types, such as olfactory, auditory, or tactile stimuli. Third, Zarcone et al. (1999) pre-trained an escape response (e.g., hand clapping), and then measured latency to the trained response in the presence of each stimulus. If problem behavior had been assessed in the presence of the various stimuli, it is possible that the assessment results may have differed, because it is not known whether the arbitrary response was functionally equivalent to participants' problem behavior. Finally, stimuli identified as non-preferred through systematic assessments have only been demonstrated to reduce problem behavior when applied as positive punishers (Fisher et al., 1994, Zarcone et al., 1999). As negative reinforcers, they have only been applied in the context of functional analyses procedures (Call et al., 2009). It may be useful to employ similar assessment procedures to identify non-preferred stimuli for subsequent use as negative reinforcers during skill acquisition procedures. For example, when teaching an alternative response to problem behavior, such as manding for escape, it may be useful to train the mand response in the presence of stimuli identified as non-preferred through a stimulus assessment.

Teaching Mands for Negative Reinforcement

The majority of studies on teaching mands for negative reinforcement have been published within literature on functional communication training (FCT). FCT consists of teaching a communication response as an alternative, appropriate means of accessing the same reinforcer that was identified as maintaining problem behavior (Tiger, Hanley, & Bruzek, 2008). Two procedural steps of FCT have consistently been reported in the literature: (a) identifying the function of problem behavior, and (b) providing the reinforcer maintaining problem behavior differentially for an alternative communication response (Wacker et al., 2005). In addition, placing problem behavior on extinction is typically a third procedural component to FCT (Tiger et al., 2008), with several studies documenting that FCT is less effective when not combined with extinction (e.g., Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998; Kelley, Lerman, & Van Camp, 2002).

The function of problem behavior has typically been identified using either antecedent assessments, in which the levels of attention and task difficulty are manipulated (Carr & Durand, 1985), or functional analyses, in which both antecedent and consequences are manipulated to identify behavioral function (Iwata et al., 1982/1994). FCT can be classified as a differential reinforcement procedure in which the functional communication response (FCR) is the alternative reinforced response (Tiger et al., 2008). The FCR can be conceptualized as a mand because it is reinforced by a characteristic consequence and comes under the functional control of relevant conditions of deprivation or aversive stimulation (Skinner, 1957). Therefore, if the function of problem behavior were identified as escape from demands, FCT would teach the individual to mand for escape from demands.

FCT procedures were first empirically documented by Carr and Durand (1985) who replaced the disruptive behavior of four children with developmental disabilities with FCRs. They first identified the conditions under which disruptive behavior was most likely to occur within an instructional setting, by manipulating levels of adult attention and task difficulty. They determined that participants' behavior was sensitive to lower levels of adult attention (one participant), difficult tasks (two participants), or both (one participant). They then taught the children to respond to the question, "Do you have any questions?" with a relevant communication response. That is, if disruptive behavior occurred under conditions of low attention, participants were taught to say, "Am I doing good work?" which would function to request attention. If disruptive behavior occurred when difficult tasks were presented, they were taught to say, "I don't understand" to access help, thus decreasing the difficulty level of tasks. Participants' acquisition of phrases that matched the function of problem behavior decreased disruptive behavior to low levels.

It is potentially advantageous to use an FCT intervention to reduce problem behavior over other intervention strategies which also address the function of problem behavior but do not teach individuals an alternative appropriate means of accessing the reinforcer that maintained problem behavior. For example, if it is found that a child engages in self-injury when presented with difficult tasks, programming could be altered so that the child is given assistance with tasks. However, this intervention places the child in a passive role, reliant on an adult to appropriately manipulate level of task difficulty, to decrease the aversiveness of tasks. In contrast, teaching children an FCR to mand for help with difficult tasks gives them an active role (Carr & Durand, 1985), increasing their control in getting their needs met. They are taught a communicative response which they can use whenever they are motivated to do so. Durand and Carr (1992) provided an empirical demonstration of the benefits of an FCT intervention over an intervention which addresses behavioral function without teaching a replacement behavior. They compared an FCT intervention to time out, for 12 children whose functional analyses demonstrated that their problem behavior was maintained by attention. They found that although both treatments were initially effective, participants whose challenging behavior was previously reduced with time out resumed problem behavior with teachers naïve to the experimental procedures and the participants' intervention histories. However, participants who had experienced functional communication training across stimulus conditions continued to use their requests with teachers both familiar and naïve to the experimental procedures and participants' intervention histories.

FCT is typically implemented while problem behavior is placed on extinction (Tiger et al., 2008). Several researchers have documented the ineffectiveness of FCT while problem behavior continues to be reinforced (e.g., Hagopian et al., 1998; Kelley et al., 2002; Shirley, Iwata, Kahng, Mazaleski, & Lerman, 1997; Worsdell, Iwata, Hanley, Thompson, & Kahng, 2000). For example, Shirley et al. (1997) found that when self-injurious behavior (SIB) continued to produce reinforcement, SIB remained at baseline rates for all three participants, and none of them acquired the alternative communication response. When extinction for SIB was added to FCT, SIB decreased and the communication response increased for all participants. In addition, Hagopian et al. (1998) evaluated the efficacy of FCT in reducing the severe problem behavior of 21 individuals with mental retardation. They found that when problem behavior continued to be reinforced, FCT was effective in reducing problem behavior by greater than 70% (as compared to baseline) in only 2 of 27 applications.[1] In contrast, when FCT was implemented with extinction (for problem behavior), problem behavior was reduced by greater than 70% in 17 of 27 applications (63%). Thus, at least for some individuals, FCT is only effective when problem behavior is placed on extinction.

FCT has been implemented to treat problem behaviors maintained by social positive reinforcement (e.g., Durand & Carr, 1992; Goh, Iwata, & DeLeon, 2000), social negative reinforcement (e.g., Durand & Carr, 1991; Lalli, Casey, & Kates, 1995), and multiply-maintained problem behavior (i.e., maintained by both positive and negative reinforcement; e.g., Day, Horner, & O'Neill, 1994; Wacker et al., 2005). In their review of 204 participants receiving an FCT intervention, Tiger et al. (2008) found that problem behavior was maintained by positive reinforcement in 61% of cases (32% attention and 29% tangible). Problem behavior was maintained by negative reinforcement in 47% of cases and overwhelmingly consisted of problem behavior maintained by escape from task demands (91% of negative reinforcement cases)[2]. Alternative negative reinforcement conditions, such as termination of loud noises or social interaction, accounted for the other 9% of negative reinforcement cases (see Frea & Hughes, 1997; Hagopian, Wilson, & Wilder, 2001 for examples of teaching FCRs to escape social interaction). Therefore, although the use of FCT is clearly well supported for reducing problem behavior negatively reinforced by escape from demands, there is little research to support its

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[1] There were greater than 21 applications because some participants exhibited multiply-maintained problem behavior, and each function was treated separately.

[2] Percentages sum to over 100% due to individuals presenting with multiply-maintained problem behavior.

effectiveness when problem behavior is maintained by other sources of negative reinforcement. This perhaps is related to the lack of an empirical methodology to identify non-preferred or aversive stimuli. Since FCT procedures typically employ antecedent assessments manipulating level of task difficulty (e.g., Carr & Durand, 1985), or functional analyses in which demands are usually presented as the aversive stimulus in the escape condition (Iwata et al., 1982/1994), an escape function is typically identified in the presence of demands. It is quite possible that alternative assessment procedures could identify non-preferred stimuli and result in identification of alternative contexts within which to teach FCRs for negative reinforcement.

In an example of teaching mands for negative reinforcement unrelated to academic demands, Yi, Christian, Vittimberga, and Lowenkron (2006) taught three children with autism to mand for the removal of non-preferred stimuli and investigated generalization of the mand response to untrained stimuli. Through parent interview, 10 putative non-preferred stimuli were identified for each participant: food items for two participants (e.g., bananas, chocolate chip cookies) and toy instruments for the third participant (e.g., maraca, jingle bells). Brief analogue assessments (Northup et al., 1991) were conducted to confirm that participant problem behavior served an escape function and to verify the aversiveness of putative non-preferred stimuli. However, it was unclear how the 10 stimuli were presented during functional analysis sessions (i.e., were stimuli presented all together or one-by-one?) to allow confirmation that problem behavior occurred to access escape in the presence of all stimuli. Yi et al. (2006) stated that functional analyses consisted of one 10 min session of each condition (i.e., escape, attention, tangible). It seems unlikely that an escape function could be demonstrated across 10 different stimuli within one 10 min session.

Prior to mand training, baseline data collection documented that manding never occurred for any participant, and problem behavior occurred on nearly 100% of trials across sessions. A baseline session consisted of 10 trials, with one trial conducted with each stimulus identified as non-preferred. At the start of each session the therapist presented one non-preferred stimulus.

When the participant engaged in problem behavior, the trial was terminated. Thus, the problem behavior appeared to function to access escape from each of the stimuli during baseline trials. However, a 30 s inter-trial interval occurred following each instance of problem behavior, in which the participant was allowed to leave their seat. It is possible that participants engaged in problem behavior to terminate the trial and leave their seat, rather than purely to escape the particular putative non-preferred stimulus presented. It could be beneficial to include control conditions during baseline to confirm that participants' problem behavior was occurring to produce escape only in the presence of non-preferred stimuli, rather than when non-preferred stimuli were absent or preferred stimuli were present. Without a clear demonstration of behavioral function during either functional analysis or baseline sessions, it is unclear whether problem behavior functioned to access escape from each of the putative non-preferred stimuli.

During mand training, Yi et al. (2006) taught two participants vocal mands for negative reinforcement (i.e., "No thanks" and "No, don't do that."), and the third participant was taught the signed mand, "No". Training was implemented with one non-preferred stimulus, using a most-to-least prompt hierarchy. Once mastery was achieved with the first item, training was implemented with a second and third item, sequentially, using a least-to-most prompt hierarchy. When mastery was achieved with the third training item, training consisted of mixed presentation and random rotation of all stimuli. Probes were then conducted with the remaining seven non-preferred items. All participants engaged in the trained mand response in 100% of generalization probes which included all seven stimuli. In addition, occurrence of problem behavior dropped to zero for all participants by the end of the study.

Yi et al. (2006) contributed to the literature by extending training of mands for negative reinforcement to non-preferred stimuli and including probes for generalization across stimuli. There are, however, several areas that were not addressed in this research. First, and importantly, Yi et al. (2006) did not include any preferred items within their training condition. Thus, it is possible that the participants' mand responses were not under appropriate motivational control and perhaps would have occurred upon presentation of any stimulus within the experimental context. Without these controls, it is impossible to know whether the participants' responses were actually functioning as mands for negative reinforcement. Second, the non-preferred items used by Yi et al. (2006) were identified through parent interview. Although caregiver interview is an acceptable starting point to the assessment of preferred or nonpreferred stimuli, it is not a replacement for the systematic assessment of stimuli. There is empirical evidence to suggest that results of interviews do not accurately identify preferred items (e.g., Mason, McGee, Farmer-Dougan, & Risley, 1989). It is reasonable to speculate that the same may be true of identification of nonpreferred items. A systematic assessment of putative nonpreferred stimuli could enhance the study of generalized manding for negative reinforcement. Third, a physical prompt consisting of holding the participants' hands down (sometimes accompanied by the vocal instruction, "Hands down") was used during mand training. It is, therefore, unclear whether the decrease in problem behavior observed was a function of acquisition of mands. Alternatively, it is possible that the physical prompt served as a positive punisher, and it alone was responsible for the decrease in problem behavior observed. Finally, during mand training, the nonpreferred item was held where the participant could see it for 4 to 5 s before placing it in contact with the participant. Therefore, participant mands could have functioned to avoid the nonpreferred stimuli on some trials, and to escape the stimuli on other trials. It was not clear from the data which type of responses occurred during each trial. It could, perhaps, clarify the results if mand training procedures targeted escape responding separate from avoidance responding.

FCT researchers have also assessed generalization of an FCR across stimuli in a limited number of studies (e.g., Durand & Carr, 1991; O'Neil & Sweetland-Baker, 2001; Wacker et al., 2005). For example, Durand and Carr (1991) identified that the problem behavior of three boys with developmental disabilities was maintained by escape from academic demands (plus social attention for one participant). After teaching mands for assistance (and attention for one participant), they found that not only did levels of problem behavior reduce significantly, but these results were observed across environments, teachers, and tasks. Mands for assistance were maintained for 18 to 24 months following training. Generalization across specific tasks was not documented. Instead, observations were carried out in the classroom one to two year(s) post-FCT: Participants used FCRs and engaged in low-levels of problem behavior in novel contexts, with naïve teachers, and across varied academic tasks.

In another example of assessment of cross-stimulus generalization of a mand response, Wacker et al. (2005) trained parents of 25 young children with developmental disabilities to conduct functional analyses and FCT with their children. Pre- and post-training probes were conducted with 12 of the 25 participants, to assess generalization of treatment across people, settings, and tasks. Problem behavior was maintained by a variety of social functions across participants, and training and generalization tasks varied across participants. For example, one participant's training occurred in the context of picking up blocks, and generalization probes were conducted within the context of tooth-brushing, picking up cars, and directed play with blocks and cars. Wacker et al. (2005) found that generalization occurred across settings, people, and tasks, though generalization across settings and people was more likely than generalization across tasks.

A systematic examination of cross-stimulus generalization of an FCR response was conducted by O'Neill and Sweetland-Baker (2001). They taught two boys with autism to mand for escape from demands by touching a break card, and assessed generalization across tasks. After conducting functional analyses to identify that participants' disruptive behaviors were maintained by escape from demands, they interviewed teachers and conducted observations to identify a set of demands considered to have a high likelihood of evoking disruptive behavior. Three tasks were identified for one participant and five tasks for the second. During FCT plus extinction for disruptive behavior, participants were taught to mand for escape in the presence of one task, using graduated gestural and physical prompts. Generalization across tasks was assessed using a within-participant multiple probe design. Probes were conducted during baseline and after substantial reductions in disruptive behavior and increases in independent mands occurred with the training task. During baseline probe sessions, mand responses and disruptive behavior resulted in a 30 s break (i.e., escape extinction was not employed). Generalization across tasks varied, with reductions in disruptive behavior and increases in mands observed across some but not all tasks. For one participant, generalization was observed to three of four tasks, with disruptive behavior remaining at baseline levels and manding almost completely absent for the fourth task. For the second participant, generalization was observed across one of two tasks, with disruptive behavior remaining at baseline levels and manding almost completely absent for the second task. The FCT plus escape extinction procedure was then implemented simultaneously across all generalization tasks, resulting in decreases in disruptive behavior to low levels across all except one task for one participant.

O'Neill and Sweetland-Baker (2001) contributed to the literature by providing an example of assessing generalization of a mand for negative reinforcement across stimuli. Specifically, they conducted several generalization probes throughout FCT, providing a measure of generalization while training was occurring. However, there are several ways in which this study could be extended. First, because training was implemented simultaneously across all generalization stimuli, there was only a single within-subject replication of the training effect demonstrated with each participant. As noted by the authors, their experimental control could have been enhanced through sequential introduction of training across tasks. Second, a non-preferred stimulus assessment was not conducted prior to training. As noted previously, teacher interview is an acceptable starting point, but not a replacement for the systematic assessment of non-preferred stimuli. Third, the specific tasks to include as non-preferred stimuli during baseline and training were only identified after the functional analysis was conducted (i.e., once an escape function for problem behavior was established). It was not clear what demands were included during functional analysis sessions. Therefore, the functional analysis did not confirm that problem behavior functioned to access escape from the specific putative non-preferred stimuli subsequently presented during training. Fourth, the authors report baseline rates of disruptive behavior in the presence of each task, demonstrating that the mand response never occurred in baseline (even though the break card was available), and disruptive behavior occurred in the presence of each task when disruption produced access to a 30 s break. However, because a control condition was not employed, in which a preferred task (or no task) was present, it is not possible to conclude that it was the presence of the particular tasks that resulted in occurrence of problem behavior: Perhaps problem behavior would have occurred under different stimulus conditions as well. Without a clear demonstration of behavioral function in the presence of the training stimuli, during either functional analysis or baseline sessions, it is unclear whether problem behavior functioned to access escape from each of the putative non-preferred stimuli. Finally, O'Neill and Sweetland-Baker (2001) provided a demonstration of generalization of a mand for negative reinforcement across some of the stimuli assessed. However, all stimuli were demands (e.g., receptive identification, cleaning, recycling, matching); it would be interesting to assess generalization of a mand for negative reinforcement across additional types of stimuli, such as non-preferred auditory or tactile stimuli.

Together, the studies conducted by Yi et al. (2006) and O'Neill and Sweetland-Baker (2001) provide the best empirical evidence of generalization of mands for negative reinforcement across stimuli. These are important findings because the ultimate success of FCT is determined by whether or not the trained mand occurs in all relevant contexts (Tiger et al., 2008). There are, however, some important limitations to these studies, which could be addressed through additional research. First, stimuli have only been identified through caregiver interview, which may be an inadequate assessment method. Second, it was not clear in either study what demands were present during the "escape" condition of functional analyses. Therefore, functional analyses did not confirm that problem behavior was maintained by negative reinforcement from the specific stimuli included during training. Finally, control conditions were not employed in either study. During baseline, the lack of control conditions again prevented the authors from demonstrating that problem behavior functioned to produce escape from the putative non-preferred stimuli. During training, the lack of control conditions prevented Yi et al. (2006) and O'Neill and Sweetland-Baker (2001) from demonstrating that the mand was under appropriate motivational control (i.e., that responses were actually functioning as mands for negative reinforcement). The addition of control conditions that include sessions with no stimuli or preferred stimuli would allow measurement of the extent to which problem behavior was occurring only in the presence of non-preferred stimuli to access escape, and help ensure that the trained mand response was under appropriate motivational control (i.e., occurring only in the presence of non-preferred stimuli to produce escape). Additional research addressing these limitations would extend the literature on generalized manding for negative reinforcement.

Conclusion

Some students with developmental disabilities likely encounter numerous stimuli every day which they escape or avoid by engaging in problem behavior. Yet the majority of research conducted on problem behavior maintained by social-negative reinforcement has used task demands as the aversive stimulus (Hanley et al., 2003). Little is known about the assessment and treatment of problem behavior maintained by sources of social-negative reinforcement other than escape from task demands. Only a handful of studies have documented the occurrence of problem behavior maintained by escape from non-task related stimuli (e.g., Smith et al., 1995). To adequately address problem behaviors maintained by various nonpreferred stimuli, it may be useful to develop additional technologies to identify a functional relation between environmental stimuli and problem behavior hypothesized to be negatively reinforced.

A first step in demonstrating a functional relation between nonpreferred stimuli and problem behavior may be to empirically identify non-preferred stimuli. However, we found minimal research on the methods to identify hierarchies of non-preferred or aversive stimuli for subsequent use in treatments to teach new responses and/or reduce problem behavior. Studies of assessment procedures to identify nonpreferred stimuli were either designed specifically to identify auditory stimuli which evoke problem behavior (Buckley & Newchok, 2006; McCord et al., 2001), or to identify aversive stimuli that were later employed as punishers (e.g., Fisher et al., 1994; Zarcone et al., 1999). Non-preferred stimuli could also be employed as negative reinforcers within skill acquisition procedures, such as teaching mands for escape. The development of assessment procedures to identify nonpreferred stimuli could enhance the effectiveness of subsequent negative-reinforcement-based mand training procedures.

Numerous studies have been conducted on teaching mands for negative reinforcement. With few exceptions, however, these studies have focused on teaching mands for escape from task demands (Tiger et al., 2008). In addition, relatively few studies have focused on training generalization of mands for negative reinforcement across stimuli. Two studies have provided the best empirical evidence of generalization of mands for negative reinforcement across stimuli (O'Neill & Sweetland-Baker, 2001; Yi et al., 2006). These studies, however, did not include systematic nonpreferred stimulus assessments, nor did they employ systematic analyses to confirm that problem behavior functioned to produce escape from each of the putative non-preferred stimuli. In addition, the lack of control conditions prevented O'Neill and Sweetland-Baker (2001) and Yi et al. (2006) from demonstrating that the mand response was under appropriate motivational control (i.e., occurring only in the presence of nonpreferred stimuli to produce escape). Therefore, the objectives of the proposed project are as follows:

- To adapt and evaluate a method (Call et al., 2009; Zarcone et al., 1999) to identify non-preferred stimuli for subsequent use in mand training
- To employ systematic analyses to demonstrate the negative reinforcement function of problem behavior in the presence of each nonpreferred stimulus selected for mand training
- To implement and assess a procedure to train mands for negative reinforcement sequentially across stimuli until generalization occurs to untrained stimuli (or all stimuli

are trained), while ensuring that the mand is under appropriate motivational control (i.e., that it is not occurring in the presence of preferred stimuli, or when no stimulus is present)

- To assess generalization of the mand response to non-training contexts outside of the experimental setting

CHAPTER III

METHOD

Participants and Setting

Two school-aged children with a diagnosis of autism participated. Both participants were identified through informal educator interviews and classroom observations. Each participant met the following inclusion criteria: (a) During observations, the child exhibited problem behavior or other behavior that might interfere with learning in the presence of particular stimuli (e.g., ear covering when the teacher claps her hands), (b) Educator interview and/or observations identified at least four putative non-preferred stimuli, (c) The child did not engage in an appropriate mand for negative reinforcement, and (d) The child had limited or no vocal communication.

Jared was a 7-year-old boy who attended a day school program at a private school for children with autism and other disabilities. He communicated using a picture-card system, independently using 57 pictures cards (approximately 2.5 cm x 2.5 cm) and a sentence strip (approximately 2.5 cm x 10 cm) with the phrase, “I want (verb) (noun)” (e.g., “I want to eat apple.”). Jared used the manual signs, “more,” “bathroom,” “eat,” and “help,” and was working to acquire vocal approximations. He could follow a few one step directions, but could follow others only with gestural prompts or contextual cues (e.g., “Push in your chair” when near a chair that was pulled out from the table). Jared required minimal assistance with self-help skills, initiating use of the bathroom, independently washing his hands, brushing his teeth and dressing. Jared’s academic programs targeted skills such as receptive identification of pictures, body parts, and his name.

Brian was a 9-year-old boy who attended a special education classroom within a public elementary school. He was a third grade student, although his classroom included students from multiple grades. Brian communicated vocally, using three to four word utterances, but very rarely initiated. Over the course of the experiment, Brian was observed to communicate vocally (e.g., "I want bathroom please," "I want Skittle®") less than a dozen times. Brian was included with his typically-developing peers for art, gym, and music classes. He could follow familiar multi-step directions, or less familiar instructions paired with gestures. Brian was independent in all self-help skills. His academic programming targeted sight word sentence reading, sentence writing, and basic addition.

We conducted sessions in available rooms near each participant's classroom. We conducted Jared's sessions at a kindergarten-sized table and chairs in the corner of an assessment room (approximately 3 m x 4 m) that included cabinets of educational materials and a table and chairs that were not used for experimental procedures. We conducted non-training environment probes in Jared's classroom, which included individual instructional cubicles for each student, as well as group spaces for play, circle time, and snack and lunch.

We conducted Brian's sessions at desks and chairs in a partitioned-off corner (approximately 1.5 m x 2 m) of an unused playroom (approximately 4 m x 6 m) connected to his classroom, containing shelves and bins of toys. We conducted non-training environment probes in the toy play section of the playroom, and in his classroom, which included several work stations for students to work in small groups. Jared's and Brian's sessions were conducted nearly every school day, up to 5 days per week.

Stimulus Assessments

Paired Stimulus Preference Assessment

We conducted an eight-item paired stimulus preference assessment (Fisher et al., 1992) to identify preferred items to include in the subsequent non-preferred stimulus assessment and experimental procedures (to be explained further below). Stimuli were identified through interviewing caregivers and/or educators, and through direct observation, and consisted of leisure items and/or activities (i.e., non-edibles). During each paired stimulus assessment trial, we placed two of the eight items simultaneously on the table, equidistant from the participant, approximately 20 cm apart. We predetermined the order of presentation of stimulus pairs by counterbalancing for order and orientation, so each item appeared equally with every other item, and equally on the left and right sides of the participant (see data sheet in Appendix A). The participant made a selection by approaching and touching one of the two stimuli. Following a selection, the therapist allowed the participant 15 s to interact with the item before removing it and presenting the next trial. Any attempts to reach for both items simultaneously were blocked (i.e., therapists placed their hands between the participants' hands and the items), and the items were re-presented, repeating the trial. If the participant did not approach either stimulus on a given trial, the trial was re-presented. If the participant still did not make a selection, the therapist moved on to the next trial. Participants very rarely reached simultaneously for both items, or failed to approach a stimulus.

Response measurement, reliability, and procedural integrity. The dependent measure for the paired stimulus preference assessment was approach responses, and was defined as the first stimulus the participant reached for and made physical contact with in each trial. Using paper and pencil data collection methods, observers recorded which stimuli were approached each trial, or "no response," if neither stimulus was selected on the re-presentation of a trial. A second observer independently recorded data in 34% of trials for Jared, and 64% of trials for Brian. An agreement was defined as both observers recording that the same stimulus was selected, and a disagreement was defined as each observer recording that different stimuli were selected on a given trial (or one observer recording "no response," while the other recorded a stimulus as being selected). Reliability was calculated as the number of agreements divided by the number of agreements plus disagreements and converting to a percentage. Reliability was 100% for both participants. Procedural integrity data were also collected on presentation of the prescribed stimuli, and presentation in the correct (right and left) positions. Procedural integrity data were collected in 34% and 64% of trials, for Jared and Brian, respectively. Procedural integrity was 100% for Jared, and 97% for Brian; the error consisted of one wrong item presented on one trial.

Nonpreferred Stimulus Assessment

An assessment of putative nonpreferred stimuli was conducted in an attempt to identify up to 10 stimuli that were nonpreferred for each participant. We identified nonpreferred stimuli by measuring latency to problem behavior in the presence of each stimulus, when problem behavior produced escape.

Types of non-preferred stimuli. We only included stimuli in this assessment that individuals would encounter in a typical day, within a school or home setting. The term 'stimuli' was used to refer to all stimulus complexes associated with events (e.g., a toy with flashing lights and sounds, a puzzle-making activity). We planned to include auditory, olfactory, and tactile stimuli, as well as additional stimuli that included a combination of sensory components (e.g., hair clippers turned on with the body of the clippers in contact with the participant's head) if surveys and/or observations indicated they may be appropriate.

Negative Reinforcement Rating Scale (NRRS). To identify stimuli that appeared to be non-preferred by Jared and Brian, each participant's mother and teacher completed a modified version of the Negative Reinforcement Rating Scale (NRRS) (Zarcone et al., 1999). The NRRS is a survey that was developed by Zarcone et al. to identify events or activities that a child may try to avoid. These included, for example, doing self-care tasks, school work, tasks that required many steps, and remaining in seat for a long period. For our purposes, we added items to the NRRS to increase the breadth of the assessment; targeting auditory, olfactory, and tactile stimuli as well (see the survey tool in Appendix C).

Observation. Survey results were corroborated through direct observation using the following procedures. Experimenters observed participants engaging in typical daily activities at school. Data were collected both to identify potentially escape-maintained problem behavior and/or other behavior that may interfere with learning (hereinafter referred to as problem behavior), and to identify putative non-preferred stimuli likely to precede the behavior (see data collection tool in Appendix A). If we identified putative non-preferred stimuli through the NRRS, but did not observe those activities in the classroom, we asked the teachers to conduct natural environment probes within the context of the observation. For example, we asked Brian's teachers to conduct a hair combing task during one observation. Observations allowed the experimenter to create a list of potential problem behavior for each participant. Problem behavior identified for Jared included ear covering and crying/whining, defined in Table 1 of Appendix B. Problem behavior identified for Brian included ear covering, destruction, and multiple topographies of self-injury, defined in Table 2 of Appendix B. During observations the experimenter also estimated latency to problem behavior in the presence of particular stimuli, to ensure that a session length of 5 min for the nonpreferred stimulus assessment and mand training sessions (described below) would be sufficient for the behavior to occur. This was done through the observer closely tracking the time (s) on a watch. When problem behavior occurred, the observer recorded the approximate duration (s) that had elapsed since the preceding stimulus. We carried out observations of at least 30 min across 3 (Jared) or 4 (Brian) days, to ensure we had sufficient opportunities to observe problem behavior in the presence of various putative non-preferred stimuli.

Assessment. Through the NRRS and direct observation, we identified 8 stimuli to assess for Jared, and 10 for Brian. Due to the brevity of the latencies between stimulus onset and behavior we encountered during observation, we set session durations at 5 min. We presented each putative nonpreferred stimulus in two 5-min sessions. In addition, we conducted two 5 min sessions with the two *preferred* stimuli each participant approached most frequently in the previously conducted preference assessment. We included the preferred stimuli as controls because participants should not emit the behaviors hypothesized to be escape-maintained in the presence of preferred items. In addition, we included these items to potentially help ensure that the assessment, overall, was less aversive. Jared's nonpreferred stimulus assessment was conducted across 8 days, two to four sessions per day. Brian's assessment was conducted across 4 days, six sessions per day. Minimally, we gave both participants 2 min between sessions to go for a walk or engage in a different activity unrelated to the study.

We presented stimuli in random order. Each session, we presented a stimulus continuously unless problem behavior occurred, which resulted in our removing the stimulus for a 30 s escape interval. At the end of the escape interval, we re-presented the stimulus regardless of whether or not problem behavior was occurring. If problem behavior was occurring, we again immediately removed the stimulus. We employed these procedures to ensure that we were not shaping up avoidance responding. We presented the 30 s escape interval contingent on occurrence of any problem behavior, whether or not the specific topography was observed during the observations in the classroom. If we reinforced a topography of problem behavior during the assessment (by providing a 30 s contingent escape interval), we reinforced every occurrence throughout the assessment.

Continuous presentation required different configurations across different types of stimuli. We presented auditory stimuli (e.g., the sound of an alarm clock) via an MP3 player and portable speakers. At the beginning of each session, we initiated the sound at or below 85 decibels (a decibel level low enough to cause no damage to the hearing of participants/therapists, as determined by a decibel reader[3]). For many audio recordings, there was variability in the volume throughout the recording (e.g., at times the yelling was louder than at others), which resulted in the decibel level at 85, or close to it throughout the session. If the stimulus was tactile (e.g., toy slime, hair clippers), we placed it in contact with the participant (i.e., the slime in the participant's hand, and the body of the hair clippers in contact with the participant's head) at the start of the session. Throughout the session, if the participant broke contact with the item, the

[3] According to the Occupational Health & Safety Administration (OSHA), the Permissible Exposure Limit (PEL) for noise is 90 db for 8 hours; www.osha.gov/dts/osta/otm/noise/standards_more.html.

therapist moved the stimulus back in contact with the participant. We presented and turned on (when applicable) non-demand stimuli with multiple sensory components (e.g., a dust buster) at the beginning of the session. If the stimulus consisted of a demand, such as combing hair, we used the standard three-step prompt hierarchy used in the demand condition of functional analyses, with the three steps being: vocal instruction, model prompt, and physical guidance (Iwata et al., 1982/1994). There was 5 s between prompt levels, and we gave brief low-intensity praise for compliance before the physical prompt. The specific stimuli assessed for Jared and Brian are presented in Table 1.

Response measurement. We collected data using paper and pencil methods (see data sheet in Appendix A), either in vivo, or from the digital videotapes recorded each session. The primary dependent variable was latency to problem behavior, which we measured from the start of the session, and from the re-presentation of the stimulus following each escape interval. Observers started a stopwatch at the beginning of the session, and recorded the time on the watch when problem behavior(s) occurred. They then recorded the time on the watch when the stimulus was re-presented at the end of an escape interval. This continued for each occurrence of problem behavior during stimulus presentation, until the session was terminated at 5 min. The mean latency to problem behavior was calculated for each stimulus, for each session. A stimulus was only considered non-preferred if problem behavior occurred in its presence in each session. The 4 stimuli with the shortest mean latency to problem behavior were included in the subsequent experimental procedures for both participants. They were dust buster, peer yelling, hair clippers, and vacuum for Jared, and crying, happy birthday, alarm clock, and applause for Brian.

Reliability and procedural integrity**.** Before beginning the non-preferred stimulus assessment, we provided training to observers until they were at or above 90% agreement with data collected by the experimenter on a training video clip of three sample sessions. Agreement was determined at two different times during sessions (a) when problem behavior occurred, and

Table 1

Stimuli Included in the Nonpreferred Stimulus Assessment

	Type of Presentation			Participant	
Stimulus	Actual Item	Auditory (MP3)	Task Demand	Jared	Brian
Alarm clock		X		X	X
Applause		X		X	X
Combing hair			X		X
Connect 4®[a]	X			X	
Crying		X		X	X
Cutting			X		X
Dust buster	X			X	
Farm[a]	X				X
Hair clippers	X			X	
Happy birthday		X			X
Maraca[a]	X			X	
Noise maker		X		X	
Peer yelling		X		X	
Picking up items			X		X
Town[a]	X				X
Toy slime	X				X
Vacuum		X		X	X
Writing			X		X

[a] = preferred stimulus

(b) when stimuli were re-presented following escape intervals. An agreement was scored if the times recorded by the two observers were within 2 s of each other.

A disagreement was scored if the recorded times differed by more than 2 s. During the non-preferred stimulus assessment, a second independent observer collected data on 65% of sessions for Jared, and 46% of sessions for Brian. Reliability was calculated as the number of agreements divided by the number of agreements plus disagreements and converted to a percentage. Reliability was 97% (range, 80% to 100%) for Jared, and 98% (range, 88% to 100%) for Brian.

An observer also recorded procedural integrity data on the therapist's behavior. We targeted the therapist behaviors of presenting the stimulus at the beginning of the session and following each 30-s escape interval, and providing escape at each occurrence of problem behavior. We scored correct implementation when the therapist presented the stimulus within 3 s of the start of the session and the end of each 30 s escape interval. Procedural integrity data were collected for 70% and 30% of sessions for Jared and Brian, respectively. Procedural integrity for presenting the stimulus within 3 s of the start of the session and the end of each escape interval was 97% (range, 75% to 100%) for Jared, and 97% (range, 89% to 100%) for Brian. Procedural integrity for providing escape at each occurrence of problem behavior was 100% for both participants.

Experimental Procedures

General Procedures

Prior to baseline, we identified a targeted mand response for each participant, through consultation with parents and teachers. The targeted mand was signing "stop" for Jared. We selected this response because Jared already communicated important, commonly used requests through sign (i.e., "bathroom," "eat," "help," and "more"). The targeted mand was signing "finished" paired with the vocal "done" for Brian, but the vocalization was not a required component of the mand response. We chose this response because Brian primarily communicated vocally, but a vocal response alone can be difficult to prompt when initially teaching a communication response (Tiger et al., 2008). We conducted two to six sessions per day, up to 5 days per week. Minimally, we gave participants two minutes between sessions to go for a walk or engage in a different activity unrelated to the study.

Dependent Variables and Measurement

During 5-min sessions, we measured occurrence of the mand response and problem behavior (see Wallace & Iwata, 1999, for rationale of selection of 5-min session duration). We collected data on the frequency of independent and prompted mands. An independent mand was defined as the participant completing the selected mand response in the absence of therapist prompting. A prompted mand was defined as the participant completing the mand response with therapist assistance in the form of physical guidance. For Brian, the definition of the mand response was modified after 14 training sessions. The new definition included the requirement that he be free of problem behavior for 2 s before signing "finished." This change was made because Brian's latency to problem behavior (e.g., ear covering) from stimulus onset was so brief, it was sometimes impossible to block (even at a 0 s delay to the prompt). We wanted to prevent the development of chained responding and eliminate any problem behavior before signing "finished." For Jared, the definition of the mand response included him being 2 s free of problem behavior before and after signing "stop" from the first training session.

Problem behavior was defined in the same manner as described in the non-preferred stimulus assessment (see Appendix B, Table 1 (Jared) and Table 2 (Brian)). Because problem behavior for both Jared and Brian included non-discrete responses (e.g., ear covering, crying/whining), we used 10-s partial interval recording procedures. We collected data using paper and pencil methods (see data sheet in Appendix A), either in vivo or from digital videos, which were recorded of each session.

Experimental Design

Across experimental phases, each participant was exposed to three different conditions in a multi-element format: no stimulus, preferred stimuli, and nonpreferred stimulus. Because the occurrence of problem behavior resulted in stimulus removal during baseline (see detailed description below), conducting these varied conditions provided the opportunity for us to demonstrate that problem behavior was related to the presence of each of the particular stimuli identified as non-preferred.

We introduced mand training sequentially across nonpreferred stimuli, using a multiple baseline design. We trained sufficient exemplars for generalization to untrained stimuli to occur (Stokes & Baer, 1977). If generalization had not occurred, we would have continued until the mand was trained in the presence of all stimuli. Because there were six legs to the multiple baseline design (i.e., four nonpreferred stimuli and two control conditions) baseline probes were only conducted as frequently as necessary to demonstrate experimental control. The sequence of experimental sessions is provided in Appendix D for both Jared (Table 1) and Brian (Table 2).

Conditions

Each participant was exposed to three different conditions conducted in a multi-element format: no stimulus, preferred stimuli, and nonpreferred stimulus. The same therapist was present with the participant across all three condition types.

No-stimulus condition. Participants were not presented with any stimuli (see Kahng & Iwata, 1998, for a rationale of the use of a no-stimulus condition). We conducted this condition first; it served as a control condition to ensure that neither problem behavior nor the mand response occurred when there was no nonpreferred stimulus present from which to escape (i.e., problem behavior was not maintained by automatic reinforcement). We interspersed no stimulus condition sessions throughout baseline and mand training phases.

Preferred stimuli condition. Prior to each preferred stimuli condition session, we presented participants with the four highest-ranked items from the paired stimulus preference assessment and gave them the opportunity to select two items. The two items selected were included in that session. We interspersed preferred stimuli condition sessions throughout baseline and mand training phases to help ensure that the mand response was under appropriate stimulus control, and was not occurring in the presence of preferred stimuli.

Nonpreferred stimulus condition. The non-preferred stimulus condition included sessions with each of the four nonpreferred stimuli identified through the prior nonpreferred stimulus assessment. Only one stimulus was present per session.

Phases

There were two experimental phases: baseline and mand training. In addition, prior to training, and once training was complete and generalization to untrained stimuli occurred, we conducted generalization probes within a nontraining environment. Assessment of responding in the non-training environment will be described following description of the training procedures.

Baseline. During baseline, we presented a non-preferred stimulus, preferred stimuli, or no stimulus at the start of each session, dependent on the condition in effect. Occurrence of both the mand response and problem behavior resulted in 30 s removal of the stimulus (whether non-preferred or preferred). If neither problem behavior nor the mand response occurred, we removed the stimulus when the session duration elapsed (i.e., at 5 min). Because the occurrence of problem behavior resulted in stimulus removal, baseline sessions conducted across the three conditions (i.e., no stimulus, preferred stimuli, non-preferred stimulus) allowed us to demonstrate that problem behavior was maintained by negative reinforcement in the presence of each non-preferred stimulus, when presented individually.

Mand training. After we established baseline levels of problem behavior and manding across conditions, we implemented mand training sequentially across nonpreferred stimuli. We first implemented training in the presence of the stimulus with the shortest average latency to problem behavior from the non-preferred stimulus assessment. We then initiated training with subsequent stimuli only after the mand response was acquired with the stimulus with the shortest average latency to problem behavior. Likewise, we did not initiate training with subsequent stimuli until the response had been acquired with the current training stimulus. Simultaneous with implementation of mand training procedures, we implemented escape extinction for problem behavior in the presence of the current training stimulus (i.e., problem behavior no longer produced 30 s of escape, resulting only in the continued presentation of the non-preferred stimulus). During probes on untreated legs, baseline contingencies continued to be in effect (i.e., problem behavior and mands both produced 30 s of escape). We continued to conduct the no stimulus and preferred stimuli conditions as they were in baseline (i.e., problem behavior and mands continued to produce 30 s of escape).

Throughout training, both independent and prompted mand responses resulted in access to 30 s escape from the stimulus. We initially trained the mand response for Brian using a physical guidance prompting procedure with a progressive prompt delay, in which we increased the delay to the prompt based on a reduction in problem behavior. For this procedure, we initially delivered the controlling prompt 3 to 5 s into the session, and 3 to 5 s following termination of each escape interval. We increased the delay by 5 s when there was a 90% reduction in problem behavior (relative to the mean rate across the last three baseline sessions) within a session *and* levels of problem behavior did not increase from the previous session. If problem behavior remained below an 80% reduction from baseline across two consecutive sessions, we decreased the delay to the controlling prompt by 5 s. This included decreasing the delay to an immediate (0 s delay) prompt if problem behavior occurred at criteria with the 3 to 5 s delay used initially. We ran only two consecutive sessions at a 0 s delay before increasing it. The terminal delay was going to be 30 s. However, after 14 training sessions with the first stimulus (i.e., crying), Brian never progressed beyond a 3-5 s delay. As a result, we changed the prompting procedure from full physical guidance to graduated guidance, allowing Brian an opportunity to complete portions of the response independently. In addition, we modified the criteria to increase and decrease the delay as follows.

We trained the mand response using a graduated guidance prompting procedure with a progressive prompt delay for Brian, beginning on his 15th training session, and for Jared, for all training sessions. To implement the graduated guidance training procedure, the therapist allowed the participant to complete the mand independently. We interrupted errors with full physical guidance, which we faded to light touch at the forearm and further to a shadowing of the arms, as the participant performed the response independently. Initially, we delivered the controlling prompt 3 to 5 s into the session, and 3 to 5 s following termination of each escape interval. We increased the delay by 5 s if the participant manded independently in 33% of opportunities within a session. We decreased the delay by 5 s if the participant had two consecutive sessions without any independent mand responses. This included decreasing the delay to an immediate (0 s delay) prompt if problem behavior occurred at criteria with the 3 to 5 s delay used initially. We ran only two consecutive sessions at a 0 s delay before increasing it. The terminal delay was 30 s. We considered the mand to be acquired when the participant produced the response 100% independently during a session, across at least two consecutive sessions.

Introduction of Additional Stimuli

Participants began mand training and escape extinction with a single non-preferred stimulus. Training procedures were not begun with a second stimulus until the mand response was acquired with the first stimulus. When generalization to an untrained stimulus did not occur, we introduced training procedures on subsequent stimuli sequentially as acquisition of the mand occurred on the immediately preceding stimulus. Introduction of training procedures across stimuli continued until we had trained sufficient exemplars for generalization to untrained stimuli to occur (Stokes & Baer, 1977).

Reliability and Procedural Integrity

Before beginning baseline data collection, we provided training to observers until they were in at least 90% agreement with data collected by the experimenter on a training video clip of three sample sessions. Each session, we measured problem behavior using 10-s partial interval recording. In addition, we recorded frequency of prompted and independent mands. Partial interval data were converted to a percentage by dividing the number of intervals with problem behavior by the number of intervals with and without problem behavior and multiplying by 100. Data collected on the frequency of mands were converted to a rate measure by dividing the frequency by the number of minutes in a session (five).

A second observer independently scored problem behavior in 42% of sessions, and mands in 32% of sessions, for Jared, across conditions and phases. A second observer independently scored problem behavior in 69% of sessions, and mands in 66% of sessions, for

Brian, across conditions and phases. Reliability was determined by dividing each session into consecutive 10-s intervals and comparing the data of the two observers. For problem behavior, an agreement was defined as both observers scoring either occurrence or non-occurrence of a response on a given interval, and a disagreement was defined as one observer scoring the occurrence of a response on a given interval, while the other observer scored the non-occurrence of a response. For the mand response, an agreement was defined as the same number of independent and prompted responses scored within a 10-s interval, and a disagreement was defined as different numbers of independent and prompted mands scored within a 10-s interval. Reliability was calculated as the number of intervals with agreement divided by the number of intervals with agreements and disagreements, converted to a percentage Reliability was 97% (range, 87% to 100%) for problem behavior and 99.5% (range, 91% to 100%) for occurrence of mands for Jared. Reliability was 97% (range, 87% to 100%) for problem behavior and 99% (range, 78% to 100%) for occurrence of mands for Brian. Either en vivo or via video clips, an observer recorded procedural integrity data on the therapist's behavior in 39% of sessions for Jared, and 30% of sessions for Brian, across conditions and phases. The observer recorded whether the therapists presented the stimulus at the start of the session and following the termination of each escape interval (within 3 s), whether they provided the prompt at the prescribed delay, and whether they provided escape contingent on problem behavior or the mand response in baseline, and the mand response (either prompted or independent) in training. Presentation of the stimulus was implemented with 99.7% (range, 89% to 100%) integrity, and providing the prompt at the prescribed delay was implemented with 95% (range, 0% to 100%) integrity for Jared. The 0% integrity was a result of running two sessions at an incorrect prompt delay. Specifically, on session 49 the prompt was delivered at a 10-s delay instead of a 3-5 s delay, for three opportunities, and on session 62 the prompt was delivered at a 20-s delay instead of a 10 s delay, for four opportunities. Procedural integrity for providing escape was 97% (range, 0% to 100%) for Jared. The 0% integrity occurred on a preferred stimulus session (82) in which only one mand occurred during the session, and the therapist failed to remove the stimuli following it. Procedural integrity for presentation of the stimulus was 94% (range, 56% to 100%) for Brian. Integrity errors for stimulus presentation consisted of presenting the stimulus greater than 3 s from the end of the escape interval (i.e., 4 s to 8 s). Procedural integrity was 100% for providing the prompt at the prescribed delay, and 99% (range, 88% to 100%) for providing escape for Brian. Following sessions in which there were lower percentages of procedural integrity due to the failures described above, researchers reviewed the cause of the errors with therapists prior to running additional sessions.

Generalization to Nontraining Environment

Prior to implementation of mand training, and following acquisition of the mand response across all nonpreferred stimuli, we conducted probes in a non-training context (i.e., classroom environments) to assess participant manding and problem behavior in the presence of stimuli that we identified as nonpreferred through the nonpreferred stimulus assessment. We conducted three observations pre-mand training, with both participants, and four observations post-mand training. Each observation included five probes for Jared pre-mand training. Brian's observations included only two to three probes with stimuli that later became training stimuli, because additional stimuli were included during probes that we then did not include as training stimuli. We also conducted fewer probes post-mand training with Brian (four per observation). In an exception, Brian's final post-training observation included 15 opportunities (instead of five), with prompting provided (as was described above) across the last four opportunities, in an attempt to help facilitate transfer of the mand response to stimuli occurring in a non-training context. Additional anecdotal observations were noted outside of the post-mand training sessions for Jared.

During the pre-training assessment observations, teaching staff who typically worked with the participants interacted with them and the contingencies normally in effect across each participants' school day were employed. These consisted of redirection of problem behavior (e.g., when ear covering occurred, the participant's hands were redirected to task). According to teaching staff, if mands occurred, they would have been reinforced, but we did not observe any. During the post-training assessment observations, we assessed whether the mand response occurred, rather than problem behavior, when the contingencies present during training were implemented in a non-training environment (i.e., 30 s escape from the stimulus contingent on occurrence of the mand, and extinction for problem behavior).

Response measurement and reliability. We collected data on occurrence of appropriate manding and problem behavior, as a per opportunity measure (see data collection tool in Appendix A). We defined problem behavior and the targeted mand response as they were within the baseline and mand training phases. In addition to the targeted mand response, observers would have recorded the occurrence of any conventional mand responses (i.e., vocal communication, sign language, picture communication responses), but none were observed pre- or posttraining. A second observer independently scored behavior in 33% of pretraining generalization probes and 70% of posttraining probes for Jared. A second observer independently scored behavior in 33% of pretraining generalization probes and 100% of post-training probes for Brian. Reliability was determined by dividing the number of agreements by the number of agreements plus disagreements, and converting to a percentage. For the mand response, an agreement was defined as both observers recording an occurrence or non-occurrence of the same mand topography on a given opportunity, and a disagreement was defined as different topographies recorded on a given opportunity, or one observer recording an occurrence while the other did not. Similarly, for problem behavior, an agreement was defined as both observers recording an occurrence or non-occurrence of problem behavior on a given opportunity, and a disagreement was defined as one observer recording an occurrence of problem behavior while the other did not. Reliability was 100% for both problem behaviors and mands, for both participants.

Social Validity

Following completion of all experimental sessions, we administered a social validity questionnaire to parents and teachers to assess their satisfaction with the results of the research. Parents and teachers were asked to rate a series of statements, using the following Likert scale: (1) Disagree completely, (2) Disagree somewhat, (3) Neither agree nor disagree, (4) Agree somewhat, (5) Agree completely (see the questionnaire in Appendix E.). Statements addressed whether parents and teachers felt that participants benefited from the study, including whether they observed participants to engage in the newly acquired mand outside of experimental sessions, at either appropriate or inappropriate times. The questionnaire also provided an opportunity for parents and teachers to express any concerns, so that we could appropriately address them.

CHAPTER IV

RESULTS

Stimulus Assessments

Paired Stimulus Preference Assessment

Figures 1 (Jared) and 2 (Brian) display the results of the paired stimulus preference assessments. We conducted preference assessments to identify preferred items to include as controls in the non-preferred stimulus assessment because participants should not emit the behaviors hypothesized to be escape-maintained in the presence of items identified as preferred. In addition, we included these items to potentially help ensure that the assessment, overall, was less aversive. We intended to add the two most preferred items to the non-preferred stimulus assessment. However, we excluded the DVD (selected on the highest percentage of trials, 79%) for Jared. Although we identified it as most preferred, we observed ear covering while Jared watched the DVD, which included sounds such as noise makers (i.e., a putative nonpreferred stimulus). We included the two next highest selected stimuli, Connect 4® and the maraca, in Jared's non-preferred stimulus assessment. Brian's highest preferred stimulus was town, followed by a four-way tie for next preferred. We included the town and the farm (which we randomly selected from the four) in Brian's nonpreferred stimulus assessment.

Prior to preferred stimuli control conditions, we presented participants with the four top-ranking items from the paired stimulus preference assessment. Participants selected two of the four to be included that session. Because the DVD was excluded for Jared, we presented Connect 4®, the maraca, the giraffe, and the bear prior to preferred stimuli sessions (Figure 1). Jared varied the two items he selected each session. Because there was a four-way tie for second highest preferred for Brian, we presented the town stimulus (highest preferred) prior to every preferred stimuli session, along with three of the four next preferred: farm, numbers, orange car, and train (Figure 2). Brian selected the town and the farm on every preferred stimuli session.

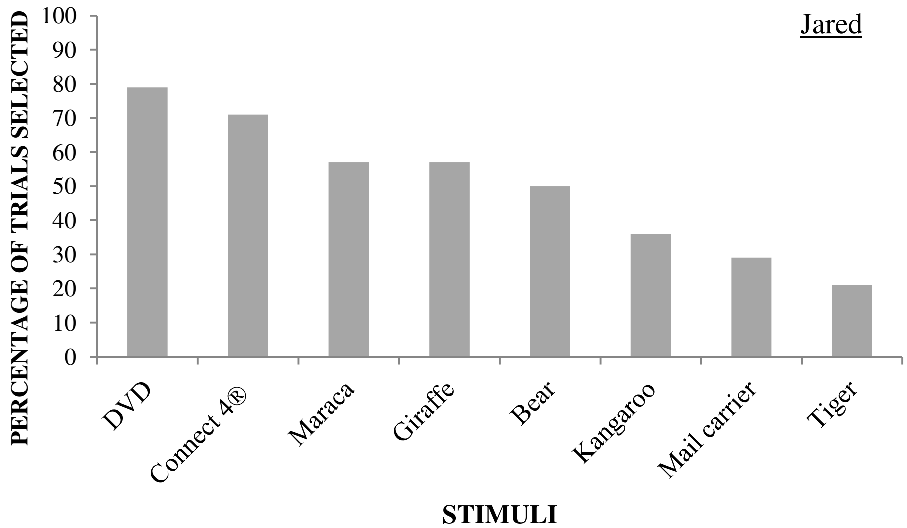

Figure 1. The percentage of trials Jared selected each stimulus during the paired stimulus preference assessment.

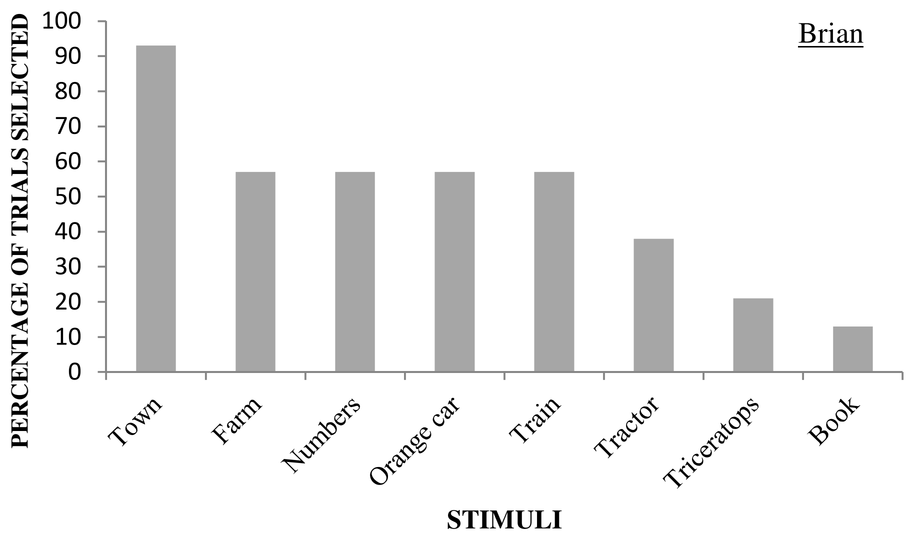

Figure 2. The percentage of trials Brian selected each stimulus during the paired stimulus preference assessment.

Negative Reinforcement Rating Scale (NRRS)

Table 2 provides a summary of Jared's mother's and teacher's responses to the NRRS (refer to Appendix C to view a copy of the NRRS survey tool). As noted in Table 2, respondents rated each item as follows: (1) Does not bother the child at all, (2) Sometimes bothers child, (3) Often bothers child, (4) Always bothers child, (DK) Don't know. Only two items were identified by both respondents as often bothering Jared: noises made by people, and noises made by toys or other items. Jared's teacher also rated when the room/area was noisy, and when Jared was in pain or uncomfortable as often bothering him. His teacher provided examples of specific auditory stimuli which bothered Jared, to include crying, screaming, stomping/banging sounds, and sudden

Table 2

NRRS Responses by Jared's Mother and Teacher

NRRS Item	Does not bother child at all	Sometimes bothers child	Often bothers child	Always bothers child	Don't know
When other people make certain noises			M T		
When a toy/item makes certain noises			M T		
When in pain or uncomfortable		M	T		
When the room/area is noisy		M	T		
High pitched noises[a]			T		
Going from one area/activity to another		M T			
Doing work that is very difficult		M T			
Doing work that requires a lot of steps		M T			
Remaining in seat for a long period		M T			
When the room/area is crowded		M T			
Doing work around the house		M			T
When unable to understand/hear people		M			T
When touching something in particular	M	T			
Doing self-care tasks independently	T	M			
Doing school work	T	M			
When there is a certain odor	M				T
When in contact with another person	M T				
When close to other people	M T				
When being helped in self-care tasks	M T				

Note. M = Mother's response; T = Teacher's response; [a] = Item added to NRRS by teacher.

high-pitched noises. Several additional stimuli were identified by either Jared's mother or teacher, or both, as sometimes bothering him, including doing work that is very difficult, work that requires a lot of steps, and remaining in seat for long periods of time.

Table 3 provides a summary of Brian's mother's and teacher's responses to the NRRS. Both respondents identified a room/area being noisy as something which always bothers Brian. Four other items were identified as always bothering Brian by one respondent, and often bothering him by the other. They were: when other people make certain noises, when toys/items make certain noises, remaining in seat for long periods of time, and when a room/area is crowded. A number of other items were identified as either always or often bothering Brian by one respondent (see Table 3 for details). Both Brian's mother and teacher noted a number of examples of specific stimuli that always or often bother Brian. For example, Brian's mother noted the auditory stimuli singing 'Happy Birthday', someone screaming or yelling, an alarm clock, horns, sirens, and the vacuum. She also noted various tasks such as combing hair, reading, writing, and picking up more than one item. Similarly, Brian's teacher noted that nearly anything that is loud bothers him, including crying.

Observation

During Jared's classroom observations, we observed two topographies of problem behavior: ear covering and whining. Several stimuli were noted to precede the problem behavior: a peer yelling, a peer banging on walls/materials, a peer engaging in loud vocalizations, noisemakers, a dust buster, and hair clippers placed in contact with Jared's head, non-blade side. Problem behavior occurred approximately 1-3 s following stimulus onset on all occasions observed with the exception of one occurrence of ear covering which occurred 18 s after presentation of the stimulus (i.e., hair clippers).

Brian's observations occurred in the classroom, in the playroom adjoining the classroom, and in the auditorium during a school-wide assembly. We observed multiple topographies of

Table 3

NRRS Responses by Brian's Mother and Teacher

NRRS Item	Does not bother child at all	Sometimes bothers child	Often bothers child	Always bothers child	Don't know
When the room/area is noisy				M T	
When other people make certain noises			M	T	
When a toy/item makes certain noises			T	M	
Remaining in seat for a long period			T	M	
When the room/area is crowded			M	T	
To stop doing an activity[a]				M	
On computer & asked to do anything[a]				M	
When touching something in particular		T		M	
Doing school work		T		M	
Doing work that is very difficult		T		M	
Doing work that requires a lot of steps		T		M	
When unable to understand/hear people			M		T
Doing work around the house			M		T
Doing self-care tasks independently	T		M		
When being helped in self-care tasks	T		M		
When in pain or uncomfortable		T			M
When close to other people	T	M			
Going from one area/activity to another	T	M			
When in contact with another person	M T				
When there is a certain odor	T				M

Note. M = Mother's response; T = Teacher's response; [a] = Item added to NRRS by teacher.

problem behavior, including ear covering, hand to head self-injury, screaming, hand to body/leg self-injury, hand to wall, and bouncing up and down in his chair. Brian's problem behavior occurred during writing and number identification work tasks in the classroom, and following a toy phone ringing in the playroom. During the assembly, problem behavior was noted after music began playing, audience applause, and someone speaking on the microphone. Problem behavior always occurred within 3 s of stimulus onset.

Nonpreferred Stimulus Assessment

Figures 3 (Jared) and 4 (Brian) display the results of the nonpreferred stimulus assessments. For Jared, the full range of average latencies is shown in the top panel of Figure 3. The lower panel is scaled from 0 to 25 s, to allow for visual discrimination of the differences in average latency across non-preferred stimuli, because the average latency to problem behavior, for Jared, was less than 23 s across all eight putative non-preferred stimuli. As shown in the top panel, problem behavior did not occur in the presence of the maraca (preferred), and only occurred in one of the two sessions with the Connect 4® game (preferred). The four stimuli which Jared responded to with the shortest average latency to problem behavior were the dust buster (1.1 s), peer yelling (4.1 s), hair clippers (5.5 s), and vacuum (10.6 s). We included these stimuli in the experimental phase.

Brian engaged in problem behavior in the presence of all 10 putative nonpreferred stimuli, as well as in the presence of the two items identified as preferred during the paired stimulus preference assessment. Brian's average latencies to problem behavior across the 12 stimuli produced a clear hierarchy, with the shortest average latencies occurring in the presence of two auditory stimuli: crying (2.5 s) and happy birthday (2.9 s). The longest average latencies occurred in the presence of the two preferred stimuli: farm (188.5 s) and town (217.5 s). Initially we conducted baseline sessions with the seven stimuli with the shortest average latencies to problem behavior. These included four auditory stimuli: crying, happy birthday, alarm clock, and applause, and three tasks: cutting, combing hair, and writing. However, Jared did not engage in problem behavior in the presence of the three tasks; therefore, we excluded them from our subsequent experimental procedures, continuing with only the four auditory stimuli.

Mand Training

Baseline

Figures 5 (Jared) and 6 (Brian) display the percent of intervals with problem behavior

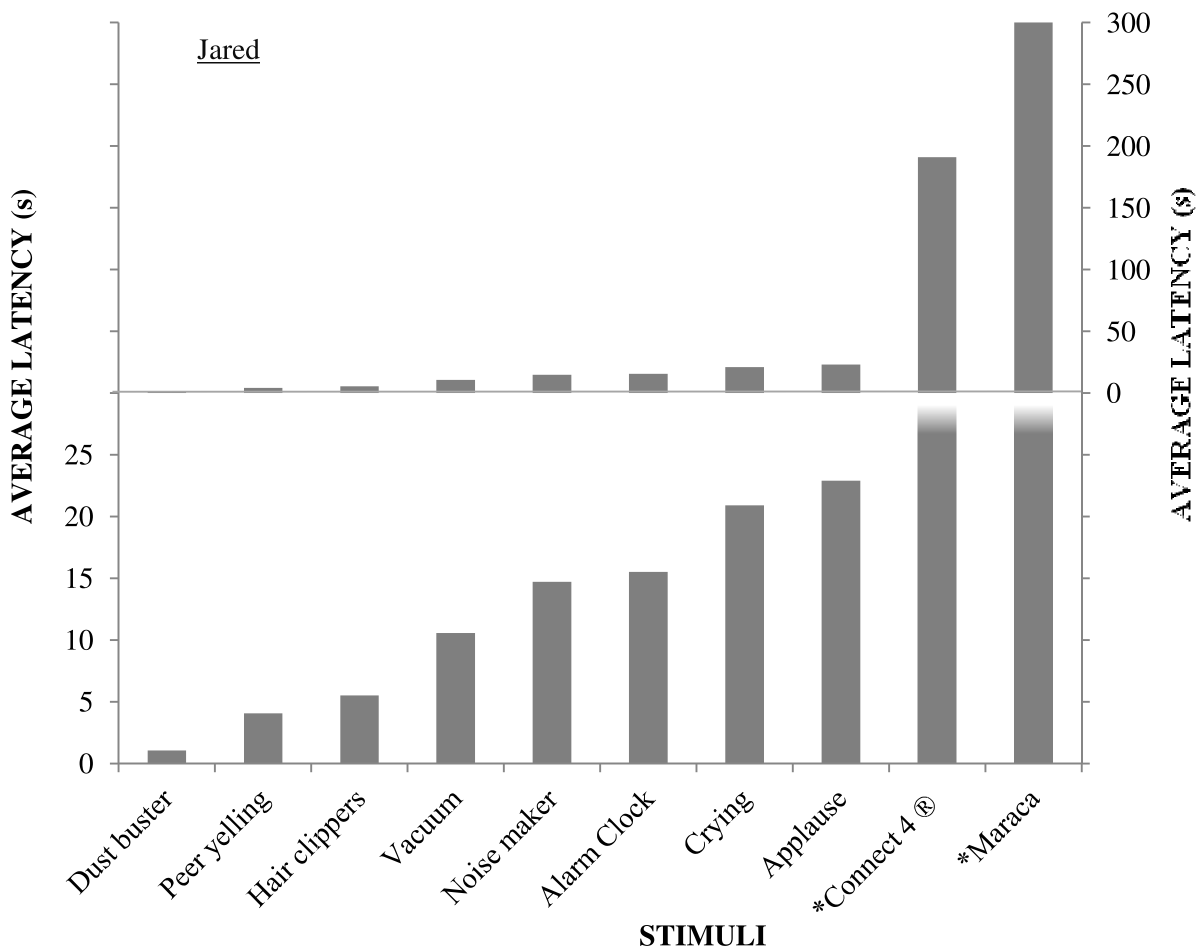

Figure 3. Jared's average latency to problem behavior in the presence of each stimulus, assessed during the nonpreferred stimulus assessment. A * indicates the stimulus was identified as preferred during the paired stimulus preference assessment. The top panel is scaled to 300 s, on the secondary y-axis, and displays the full range of latencies. A latency of 300 s indicates an absence of problem behavior across assessment sessions. The bottom panel is scaled to 25 s, on the primary y-axis, to allow for visual discrimination of the differences in average latency across nonpreferred stimuli. Note that the Connect 4® and Maraca preferred stimuli on the bottom panel extend beyond the graph.

across conditions, during baseline sessions. There was some variability observed in the percent of intervals with problem behavior across nonpreferred stimuli for Jared. He engaged in more problem behavior in the presence of the dust buster and peer yelling stimuli, as compared to the hair clippers and vacuum stimuli. However, Jared engaged in problem behavior during all sessions conducted with non-preferred stimuli, and during none of the control condition sessions (i.e., when only preferred stimuli were present, or when no stimuli were present), demonstrating a functional relation between the presence of each of the nonpreferred stimuli and the occurrence of problem behavior to access escape. That is, under conditions in which engaging in problem

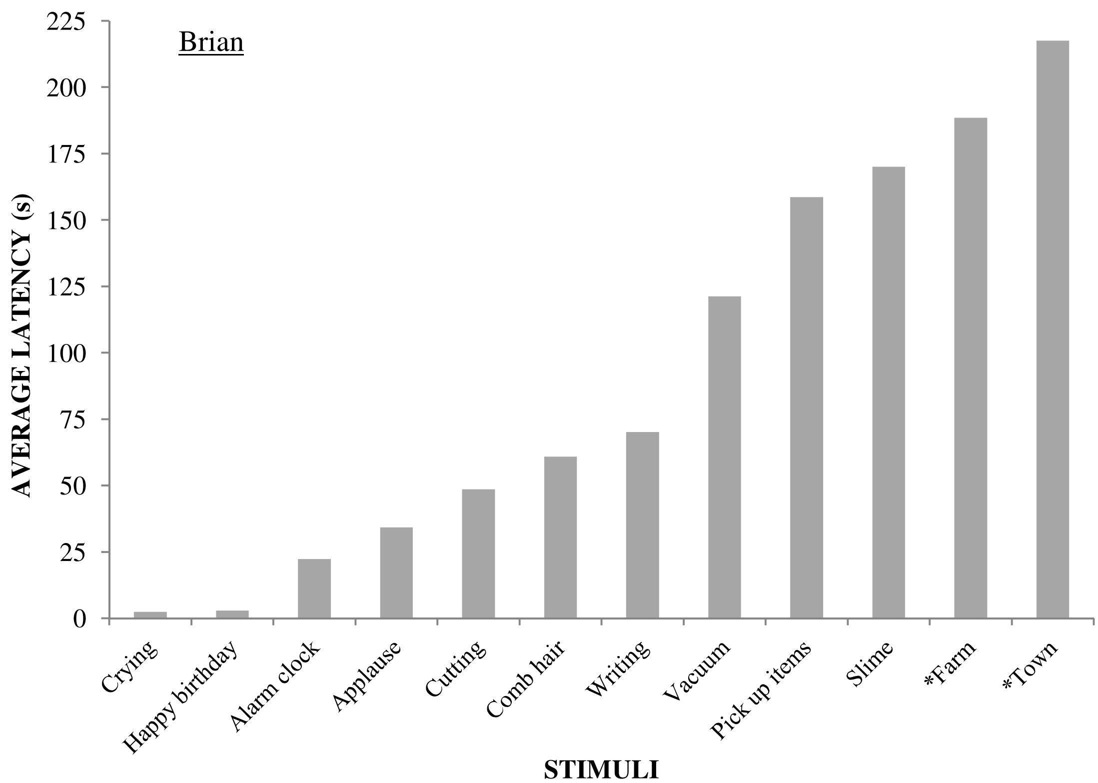

Figure 4. Brian's average latency to problem behavior in the presence of each stimulus, assessed during the non-preferred stimulus assessment. A * indicates the stimulus was identified as preferred during the paired stimulus preference assessment.

behavior produced escape from the stimulus, Jared engaged in problem behavior when each of the four nonpreferred stimuli were presented individually, and he did not engage in problem behavior when those stimuli were absent. These results suggest an escape function for Jared's problem behavior, in the presence of all four nonpreferred stimuli.

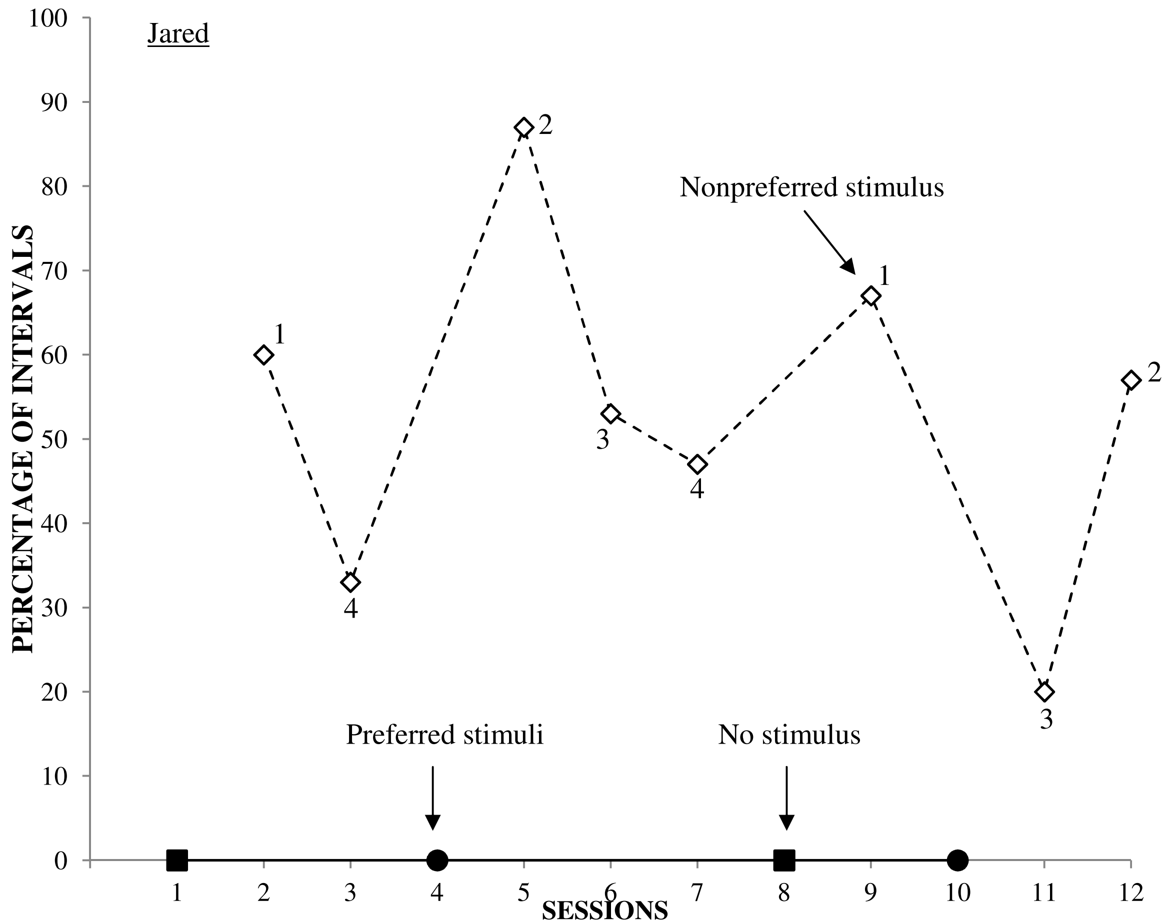

Figure 5. Baseline: Percentage of intervals problem behavior across the no stimulus (squares), preferred stimuli (circles), and nonpreferred stimuli (diamonds) sessions for Jared. The numbers above each nonpreferred stimulus data point indicate which stimulus was present each session: (1) dust buster, (2) peer yelling, (3) hair clippers, and (4) vacuum.

Brian's baseline data were more variable, resulting in us running additional sessions. Brian engaged in problem behavior during all but the first session of each control condition (i.e., in both the no stimulus and preferred stimuli conditions). However, levels of problem behavior during control conditions were lower than in all non-preferred stimulus sessions, with the exception of one session in each control condition. Therefore, there was little overlap between control condition sessions and non-preferred stimulus sessions. Percentage of intervals with problem behavior varied within the non-preferred stimulus condition. Brian consistently responded with more problem behavior during the alarm clock stimulus, as compared to the crying and happy birthday stimuli, and his responding during the applause stimulus was variable. However, Brian engaged in problem behavior when each of the four non-preferred stimuli were presented individually in a greater percentage of intervals than during control condition sessions, thus demonstrating a functional relation between the presence of each of the non-preferred stimuli and the occurrence of problem behavior. These results suggest an escape function of Brian's problem behavior in the presence of all four non-preferred stimuli.

Mand Training

Figures 7 (Jared) and 8 (Brian) display the percentage of intervals with problem behavior and mand responses per minute, during control conditions and the non-preferred stimulus condition. The data are displayed in a multiple baseline format, to highlight the effects of the sequential introduction of training across stimuli. The data points at the start of each condition are the same data that were presented in the multi-element baseline graphs (Figures 5 and 6).

Jared engaged in almost no problem behavior or mands during the no stimulus and preferred stimuli control conditions, depicted in the top two legs of Figure 7. Following six baseline sessions with no mands and stable moderate rates of problem behavior, we began training with the dust buster stimulus. During training sessions, prompted and independent mands resulted in 30 s escape from the stimulus, and problem behavior resulted only in the continued presentation of the stimulus (i.e., problem behavior was placed on extinction). We saw an immediate decrease in problem behavior in the presence of the dust buster, while levels of problem behavior remained moderate to high across all other non-preferred stimuli. After 16 training sessions with minimal independent mands in the presence of the dust buster, Jared mastered the mand response on the 18th training session. When we then introduced training with the peer yelling stimulus, we saw an immediate decrease in problem behavior, while

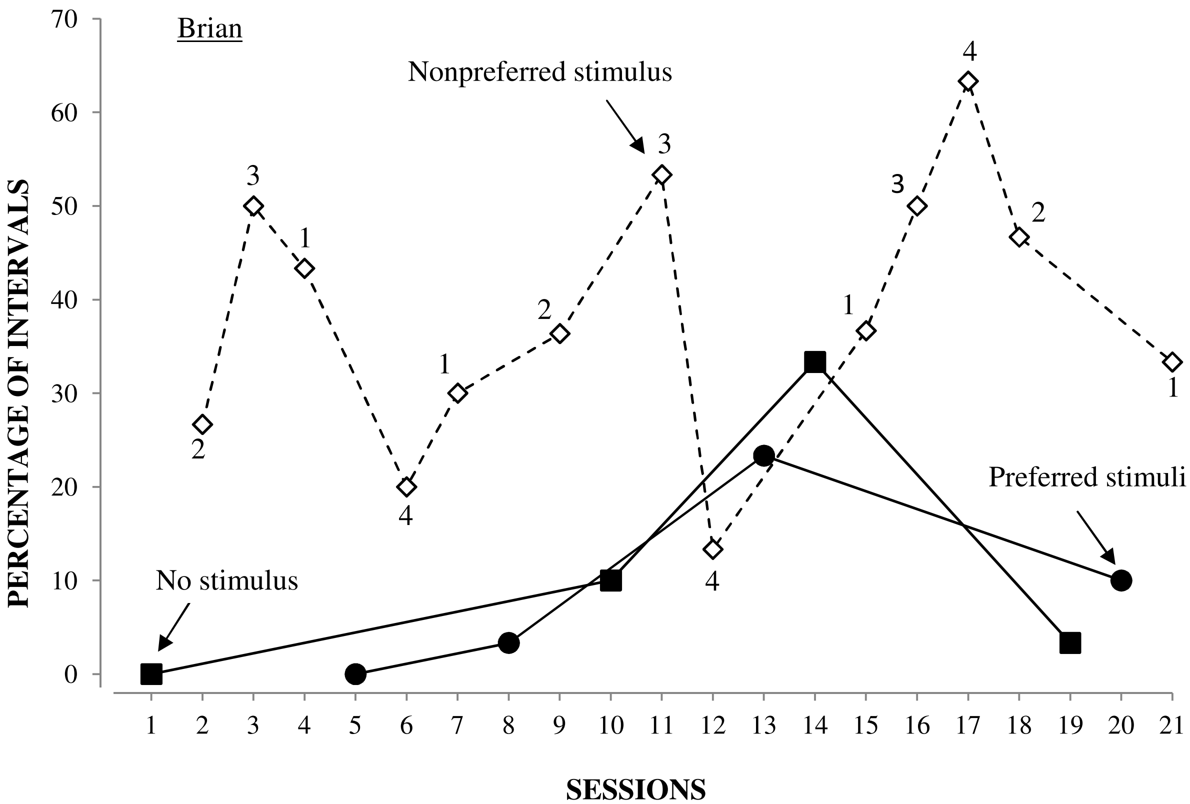

Figure 6. Baseline: Percentage of intervals problem behavior across the no stimulus (squares), preferred stimuli (circles), and nonpreferred stimuli (diamonds) sessions for Brian. The numbers above each nonpreferred stimulus data point indicate which stimulus was present each session: (1) crying, (2) happy birthday, (3) alarm clock, and (4) applause.

levels of problem behavior remained elevated with the remaining two stimuli (i.e., hair clippers and vacuum). The mand response was acquired quicker, in only nine training sessions, and we observed independent responses more immediately. As Jared approached mastery of the mand response with the second training stimulus, we began to see evidence of generalization to the remaining stimuli. For the hair clippers stimulus, we saw variable increases in manding and decreases in problem behavior across sessions, but increases in mands did not persist. Thus, we introduced training on session 100, resulting in problem behavior nearly disappearing and acquisition of the mand response in five sessions. For the vacuum stimulus, independent mands increased and remained high, concurrent with approach to mastery of the mand with the peer yelling stimulus. At the same time, problem behavior nearly dropped out altogether. Jared met mastery criteria for the vacuum on session 99, in the absence of training.

Overall, for Jared, through inclusion of the control conditions, we showed that the motivational control of the mand response was appropriate, occurring nearly exclusively in the presence of nonpreferred stimuli. In addition, we showed decreases in problem behavior which corresponded to the acquisition of the mand response. We also showed a lack of generalization to untrained stimuli until Jared was approaching mastery with the second training stimulus, at which point we saw some generalization to the other two untrained stimuli (which only persisted with the vacuum stimulus). We also saw evidence of generalization with the decrease in training time required across stimuli.

Brian engaged in almost no mands during the no stimulus and preferred stimuli control conditions, depicted in the top two legs of Figure 8. Although he engaged in problem behavior variably during these conditions, overall levels were lower than those observed with any of the nonpreferred stimuli. Following four baseline sessions with no mands and stable moderate rates of problem behavior, we began training with the crying stimulus. We saw one session with a marked increase in problem behavior, followed by levels slightly lower than those observed during baseline. As training progressed, we saw variable increases in independent mands, and

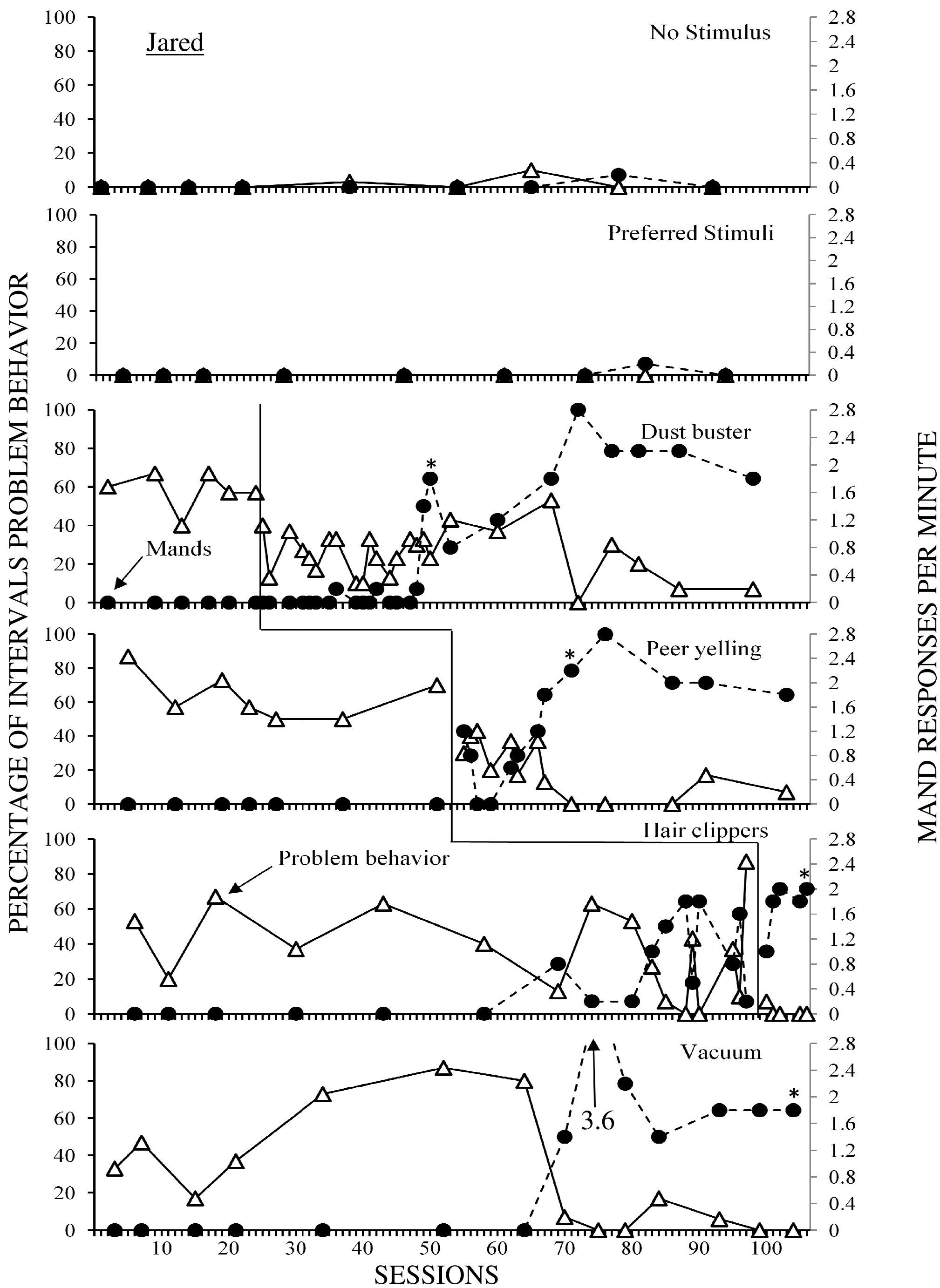

Figure 7. Percentage of intervals problem behavior (triangles) and mands (circles) per minute across baseline and mand training sessions for Jared. The top two legs are the control conditions. Training was introduced sequentially across the dust buster, peer yelling, and hair clippers, in the middle three legs. No training was conducted with the vacuum stimulus, the bottom leg. Asterisks (*) indicate the session in which the mastery criterion was met with each stimulus.

Brian never progressed beyond a 3-5 s delay after 14 training sessions. Therefore, we modified the training procedure for the mand response from physical guidance in which we progressively increased the prompt delay based on a reduction in problem behavior, to graduated guidance with the prompt delay increased and decreased based on independent performance of the mand. In addition, we modified the definition of a mand to include 2 s free of problem behavior prior to it. When we made these changes, we initially saw several sessions with no independent mands because prompts were required to teach Brian that the mand would only be reinforced if he was 2 s free of problem behavior prior to it. Following several prompted sessions, we saw steadily increasing independence in the mand response until Brian met the criteria for acquisition, following 18 training sessions with the revised procedures. With acquisition of the mand, we also saw a marked decrease in levels of problem behavior. Throughout training with the crying stimulus, probes conducted across all other nonpreferred stimuli showed stable levels of problem behavior and the absence of mands. When we introduced training with the happy birthday stimulus, we saw an immediate decrease in problem behavior, and rapid acquisition of the mand response (in only five training session). Immediately after we introduced training on the happy birthday stimulus, we observed evidence of generalization to the two remaining stimuli (i.e., alarm clock and applause). Across both stimuli, we saw stable increases in independent mands, and decreased levels of problem behavior. After six sessions with clear evidence of generalization to the alarm clock stimulus, Brian had not met the mastery criteria for the mand response. Therefore, we implemented training in an attempt to facilitate faster acquisition. Following five training sessions, Brian met the mastery criteria with the alarm clock stimulus. Concurrently, Brian met the mastery criteria with the applause stimulus, on session 99, in the absence of training.

Overall, for Brian, through inclusion of the control conditions, we showed that the motivational control of the mand response was appropriate, occurring in the presence of non-preferred stimuli. In addition, we showed decreases in problem behavior which corresponded to the acquisition of the mand response across stimuli. We also showed a lack of generalization to untrained stimuli until training was introduced with the second training stimulus. We observed generalization to the other two untrained stimuli, with the effects further enhanced by the introduction of training on the alarm clock stimulus. In addition, we saw evidence of generalization with the decrease in training time required for later stimuli.

Generalization Probes

We collected probe data on occurrence of problem behavior and appropriate manding in a nontraining environment, pre- and postintervention. Pretraining, Jared engaged in problem behavior in 100% of opportunities (15 of 15), and produced no appropriate mands for escape (0 of 15). Three probe sessions were conducted directly following acquisition of the mand across all four training stimuli, and another probe session was conducted two weeks later. During the immediate post-training probes, Jared engaged in problem behavior in 20% of trials (3 of 15), and manded in 87% of trials (13 of 15). Following an additional two weeks, Jared engaged in problem behavior in 20% of trials (1 of 5), and manded in 100% of trials.

Prior to training, Brian engaged in problem behavior in 100% of opportunities (8 of 8), and did not produce any appropriate mands for escape (0 of 8). During three post-acquisition non-training environment probe sessions, Brian manded in 50% of opportunities (6 of 12), and engaged in problem behavior in 25% of opportunities (3 of 12). During the probe sessions, we noted that Brian manded when the stimulus was played using the MP3 recording that was used in training sessions (i.e., crying and alarm). However, when the stimulus was “live” (i.e., us singing happy birthday and applauding), Brian engaged in problem behavior and did not mand. In an attempt to facilitate transfer of the mand response to stimuli more typical of the natural environment, we ran a fourth probe session, with only the happy birthday stimulus.

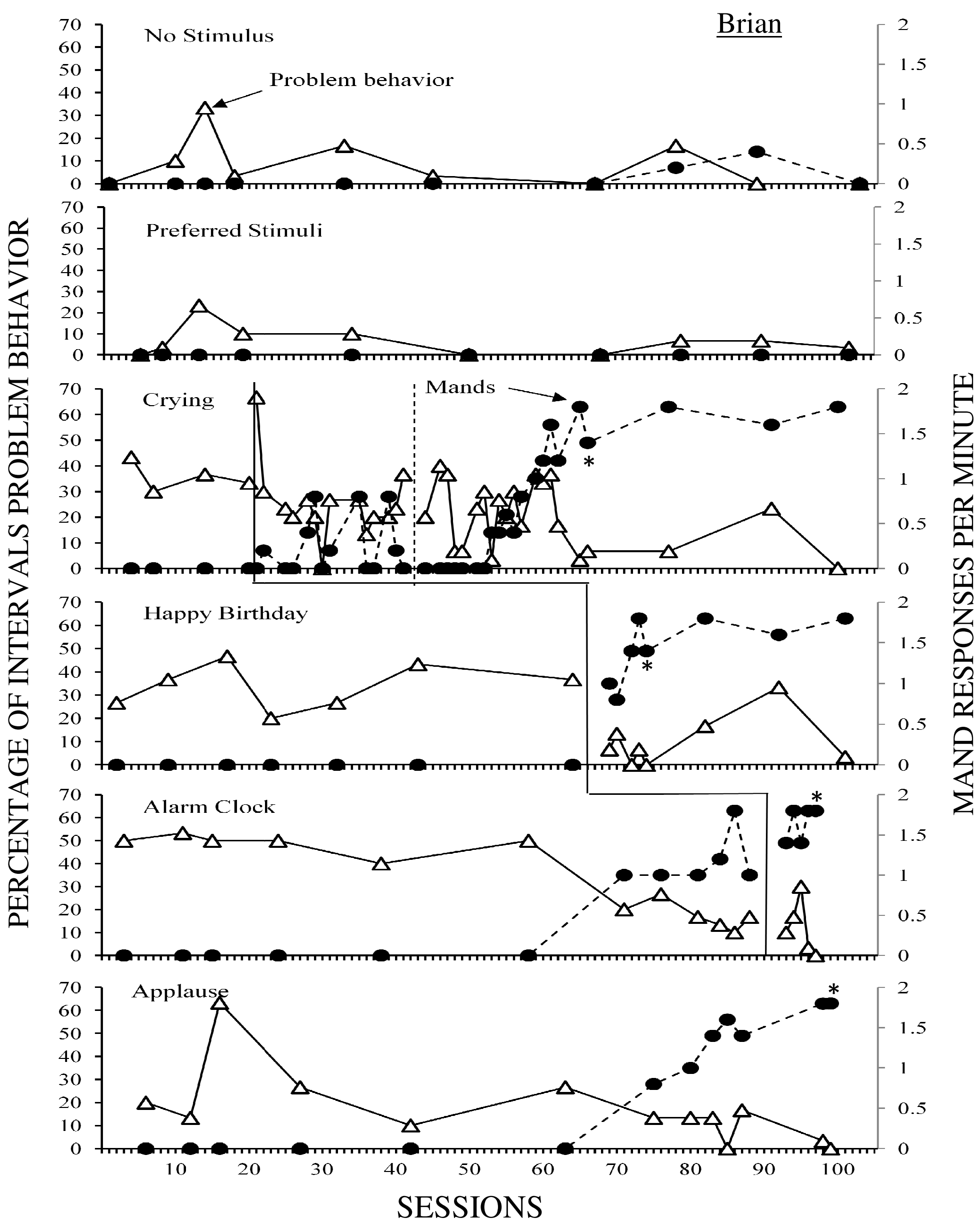

Figure 8. Percentage of intervals problem behavior (triangles) and mands (circles) per minute across baseline and mand training sessions for Brian. The top two legs are the control conditions. Training was introduced sequentially across crying, happy birthday, and alarm clock, in the middle three legs. The dashed line in the crying leg corresponds to our change in prompting procedure, problem behavior definition, and criteria to increase and decrease steps. No training was conducted with the applause stimulus, the bottom leg. Asterisks (*) indicate the session in which the mastery criterion was met with each stimulus.

During the first five trials, happy birthday was sung live. Brian engaged in problem behavior in 60% of opportunities, and did not mand. During the next five trials, happy birthday was played from the MP3 player. Brian manded in 100% of opportunities, and did not engage in problem behavior. During the final six trials, happy birthday was sung live. Brian engaged in problem behavior in 83% of trials (5 of 6), and never manded independently. After two trials without mands, we began prompting, using the graduated guidance procedures employed during training. For two trials Brian resisted the prompts, but on the final two trials, he allowed me to prompt, although he also engaged in problem behavior.

Social Validity

Both participants' mothers and teachers completed social validity questionnaires (See survey tool in Appendix E). They rated each questionnaire item as follows: (1) Disagree completely, (2) Disagree somewhat, (3) Neither agree nor disagree, (4) Agree somewhat, (5) Agree completely. All four respondents completely agreed that it is important for their child/student to appropriately communicate that they do not like/want something. In addition, all four respondents either somewhat or completely agreed that their child/student benefited from participating in this research. Jared's mother stated, "Adding a new response has been huge." Three of four respondents indicated that they have seen their child/student use the response outside of experimental sessions (with Brian's mother indicating that she had not yet seen it at home). We also asked parents and teachers whether they felt their child/student engaged in less problem behavior when they encountered something they did not like, after participating in the research. Brian's caregivers agreed somewhat. Jared's mother neither agreed nor disagreed, and his teacher disagreed somewhat, indicating that he still covers his ears frequently. None of the respondents indicated that their child/student was using the request too frequently, with the exception of Jared's teacher who indicated that he was using it in place of his signs for "help" and "more." The final item on the questionnaire asked whether the child/student uses the request at times when the respondent cannot grant it. Both Brian and Jared's teacher agreed somewhat with the statement, and Jared's teacher indicated that it is difficult to grant when he is manding in response to another student tantrumming.

CHAPTER V

DISCUSSION

The purpose of this study was to teach children with developmental disabilities a generalized mand for negative reinforcement. As discussed previously, this study was designed to (a) adapt and evaluate a method (Call et al., 2009; Zarcone et al., 1999) to identify non-preferred stimuli for subsequent use in mand training; (b) employ systematic analyses to demonstrate the negative reinforcement function of problem behavior in the presence of each non-preferred stimulus selected for mand training; (c) implement and assess a procedure to train mands for negative reinforcement sequentially across stimuli until generalization occurs to untrained stimuli (or all stimuli are trained), while ensuring that the mand is under appropriate motivational control; and (d) assess generalization of the mand response to non-training contexts outside of the experimental setting.

Results of this study address the objectives outlined above. First, we expanded procedures developed by Zarcone et al. (1999) to evaluate the aversiveness of various types of putative non-preferred stimuli in addition to task demands (e.g., auditory and tactile stimuli). We began the assessment with administration of an expanded version of the Negative Reinforcement Rating Scale (NRRS), which we used in conjunction with classroom observations, to identify putative non-preferred stimuli to include in a systematic assessment of nonpreferred stimuli. We used the results of the assessments to rank order stimuli according to the average latency to problem behavior in the presence of each stimulus. By using latency to problem behavior as a measure, we replicated the procedural variation employed by Call et al. (2009), rather than using latency to a trained response as the measure, as the procedure was originally designed by Zarcone et al. (1999). We also extended the procedures of Call et al. (2009); instead of ending each session at the first occurrence of problem behavior as they did, we measured latency to problem behavior repeatedly throughout the session, from onset of the stimulus following each escape interval. This allowed for repeated measurement of the latency. The four stimuli with the shortest average latency to problem behavior were then included in subsequent baseline and mand training experimental phases.

The nonpreferred stimulus assessment proved to be effective in identifying non-preferred stimuli to use as negative reinforcers, because both participants acquired the mand responses in the presence of the stimuli identified as non-preferred through the assessment. Prior to this study, assessment procedures to identify non-preferred stimuli were either designed specifically to identify auditory stimuli which evoke problem behavior (Buckley & Newchok, 2006; McCord et al., 2001), or to identify aversive stimuli that were later employed as punishers (e.g., Fisher et al., 1994; Zarcone et al., 1999). The current study demonstrated that, for two participants, non-preferred stimuli identified through systematic assessment could be used effectively as negative reinforcers within a skill acquisition procedure, specifically to establish mands for escape from various stimuli.

Second, we demonstrated the negative reinforcement function of problem behavior in the presence of each stimulus selected for mand training. We did this by conducting sessions in which each of the four non-preferred stimuli selected for mand training were presented individually while occurrence of problem behavior resulted in 30 s escape. This allowed us to compare levels of problem behavior in the presence of each stimulus with levels of problem behavior within the two control condition sessions: no stimulus, and preferred stimuli. When problem behavior occurred at elevated levels in the presence of each of the non-preferred stimuli, as compared to control conditions, we demonstrated that each stimulus targeted for mand training functioned as a negative reinforcer. In their article on the benefits of Skinner's analysis of verbal behavior for children with autism, Sundberg and Michael (2001) state that mands evoked by aversive stimuli must be specifically taught to children with autism, and these responses must be under control by the appropriate establishing operation (EO). By demonstrating that each non-preferred stimulus functioned as a negative reinforcer, we demonstrated that the appropriate establishing operation (EO) was likely in effect when teaching the mand response. This was an important extension of the literature, as none of the prior studies on generalization of negatively reinforced mands identified in our literature review established that problem behavior was maintained by negative reinforcement prior to mand training. Yi et al. (2006) conducted a brief functional analysis including one 10-min test condition for negative reinforcement, without specifying which putative nonpreferred stimuli were included in the session. O'Neill and Sweetland-Baker (2001) conducted functional analyses prior to identifying demands to use as negative reinforcers during mand training, and did not specify which demands were used during the escape condition of the functional analyses. Like the functional analyses reported by Yi et al. (2006) and O'Neill and Sweetland-Baker (2001), typically during functional analysis sessions, when problem behavior is identified as escape maintained, it is only in the presence of a selected, typically small, set of demands included to establish an escape function for problem behavior, in general. Problem behavior typically is not assessed in the presence of specific stimuli to establish an escape function for problem behavior in the presence of these specific stimuli. In place of standard functional analyses, we conducted test conditions for negative reinforcement with each non-preferred stimulus, and included no stimulus and preferred stimuli control conditions. This allowed us to establish a negative reinforcement function for problem behavior in the presence of each stimulus targeted for mand training.

Third, using a multiple baseline design, we trained mands for negative reinforcement sequentially across stimuli until generalization occurred to untrained stimuli (Stokes & Baer, 1977), while ensuring the mand was under appropriate stimulus control. The amount of training required for generalization to occur was very similar across participants. We saw a lack of generalization while training was implemented on the first stimulus. When training was introduced on the second stimulus, for Brian, and when Jared was approaching mastery with the second stimulus, we began to see generalization to the remaining untrained stimuli. Both participants showed generalization to the third stimulus, but this generalization did not bring the mand response to criterion levels; we implemented our training procedures, and students quickly reached criterion levels. Both participants generalized the mand response to the fourth and final nonpreferred stimulus, reaching the mastery criterion in the absence of training. In addition, in all cases, as the participants acquired the mand responses across stimuli, problem behavior decreased. Yi et al. (2006) and O'Neill and Sweetland-Baker (2001) demonstrated generalization of a mand response across putative non-preferred stimuli. However, because neither study included control conditions (i.e., no stimulus and preferred stimuli conditions), it remains unclear whether participants' responses were truly mands for negative reinforcement. It is possible that the responses emitted in the presence of various putative non-preferred stimuli could have been under the control of the experimental context and would have occurred in the presence of any stimulus presented. By including no stimulus and preferred stimuli control conditions in the current study we demonstrated that the mand responses were for negative reinforcement in the presence of each of the nonpreferred stimuli. Although mands increased in the presence of the non-preferred stimuli as we introduced training sequentially, they remained at baseline levels in the control conditions, thus demonstrating that the mand responses were controlled by the presence of each of the nonpreferred stimuli.

Finally, we assessed generalization of the mand responses to non-training contexts outside of the experimental setting. Although there were some limitations to these procedures, and to the setting generalization observed (which will be discussed further below), testing for the trained mands in a non-training context allowed us to provide evidence that the responses generalized to settings that were part of each participant's typical day. These results contribute to a small but growing group of studies which demonstrated generalization of mands for negative reinforcement to nontraining contexts (e.g., Durand & Carr, 1991; Wacker et al., 2005). In addition to the formal generalization probes, for Jared, one week after the final non-training environment probe session, anecdotal observations suggested further appropriate generalization of his trained mand (i.e., signing, "stop"). During the observation, Jared did not appear to be feeling well; he was crying and felt warm to the touch. When his teacher attempted to check his temperature by placing a thermometer in his ear, he signed “stop.” This was not reinforced, as she needed to continue to get an accurate reading on the thermometer. A few minutes later in the nurse’s office, Jared signed “stop” again while the nurse checked his ears. The nurse responded to the mand by giving him a break from checking his ears, and then having him “help” her. He did not engage in problem behavior either when the teacher was checking his temperature or when the nurse was examining his ears. Later that same day, at lunch in the classroom, Jared’s teacher was attempting to have him eat food which he clearly did not want (i.e., he was turning his head and pushing it away). Jared looked at his teacher and signed, “stop.” During these observations, Jared only signed “stop” when stimuli were present which functioned as a motivating operation establishing escape as a reinforcer for the mand. These anecdotal observations were promising, because they provided evidence that perhaps Jared was generalizing the trained mand to appropriate stimuli quite different from those targeted during mand training.

Overall, the results of this study contributed to the literature by providing an additional example of assessment and treatment of problem behavior maintained by sources of negative reinforcement other than task demands. Aside from a handful of studies (e.g., Buckley & Newchok, 2006; Derby et al., 1994; McCord et al., 2001, Smith et al., 1995), the majority of research documenting problem behavior maintained by escape has examined task demands as the aversive stimuli (Hanley et al., 2003). Similarly, with respect to FCT interventions, although negative reinforcement is a common function addressed, alternative responses have overwhelmingly been targeted in the context of escape from task demands (Tiger et al., 2008). This, perhaps, may be a result of the standard functional analysis procedures described earlier, in which there is typically only a limited set of stimuli included within a single condition testing for social negative reinforcement, typically consisting of task demands. In the current study, we extended the literature by employing alternative assessment methods to analyze problem behavior maintained by negative reinforcement in the presence of various auditory and tactile stimuli (e.g., the sound of an alarm, hair clippers in contact with the participant's head, non-blade side), and then implementing mand training procedures to teach participants functional communication responses to escape the aversive stimuli.

The focus of this study was on generalization of mands for negative reinforcement. This focus has required the identification and assessment of stimuli to use as negative reinforcers. Other researchers assessing stimuli to employ as punishers or negative reinforcers have used various terminology to describe their stimuli and procedures. For example, Fisher et al. (1994) referred to their assessment as a "stimulus avoidance assessment" thereby describing the behaviors which occurred in the presence of the stimuli. Zarcone et al. (1999) described their assessment as a "negative-reinforcer assessment" although they then used stimuli identified through the assessment as punishers in a subsequent intervention. Call et al. (2009) referred simply to a "demand assessment", as they only evaluated task demands. In the current study, we chose to refer to our assessment of stimuli for subsequent use as negative reinforcers as a "non-preferred stimulus assessment", and the stimuli as "putative non-preferred stimuli" until they were confirmed as "non-preferred stimuli" through the assessment. This choice of terminology parallels the use of the term "preferred stimuli" in the preference assessment literature, to refer to stimuli that have been assessed on the basis of preference, before later being validated as reinforcers (e.g., Roscoe, Iwata, & Kahng, 1999). It could, perhaps, be argued that our non-preferred stimulus assessment was also a negative reinforcer assessment, because we were measuring the latency to problem behavior, when problem behavior produced escape. It is not possible to know, however, whether something is actually going to function as a negative reinforcer until it is assessed in a particular context and the behavior it is contingent on is measured and found to increase. Therefore, we could not confirm the non-preferred stimuli identified through our assessments would actually function as negative reinforcers during mand training until we had evidence of acquisition of the mand responses.

We also used the term “aversive” to describe the types of stimuli we identified and assessed through our procedures. According to Cooper et al. (2007) an aversive stimulus is “an unpleasant or noxious stimulus; more technically, a stimulus change or condition that functions (a) to evoke a behavior that has terminated it in the past; (b) as a punisher when presented following a behavior, and/or (c) as a reinforcer when withdrawn following a behavior” (p. 690). We used the term “aversive” throughout the introduction to this study because we wanted to convey that we are describing unpleasant stimuli or noxious stimuli, that is, stimuli that are aversive enough that an individual would respond in such a way so as to escape or avoid them. However, we chose to use the terminology “non-preferred stimulus” and “negative reinforcer” throughout our descriptions of methods for the reasons described above, and because the term “aversive” is less specific, as it can refer to stimuli which function as punishers or negative reinforcers, as describe above by Cooper et al. (2007). Although the stimuli we assessed could have been employed as punishers, using the term negative reinforcers more specifically identified the manner in which we chose to utilize the aversive stimuli included in the current study.

Dependent Measures

We experienced some challenges and idiosyncrasies that may have been specific to our participants and their topographies of problem behavior, but perhaps warrant further discussion. First, for both participants, we observed ear covering as the primary topography of problem behavior. That specific topography presented some difficulties, with respect to auditory stimuli, which other topographies of problem behavior (e.g., aggression, hand to leg self-injury) would not share. When we put problem behavior, including ear covering, on extinction, we no longer terminated the stimulus in response to problem behavior. However, when participants engaged in ear covering, the sound was still attenuated somewhat, which made it impossible for us to make the response completely non-functional. As depicted in Figures 7 and 8, though we did see decreases in problem behavior across both participants, levels did not drop down to the floor.

This may have been a result of the partial attenuation of the sound produced by ear covering. In addition, perhaps both participants engaged almost exclusively in ear covering *because* that topography of problem behavior attenuated the sound somewhat, whereas other topographies did not.

We encountered two additional challenges when treating Brian's ear covering. First, it was possible for him to cover one ear with his shoulder while signing "all done." Second, his latency to ear cover was so immediate upon initiation of the auditory stimulus that it sometimes was not possible to block the response. These challenges resulted in the definitional change described in the Method section, which required the absence of problem behavior for 2 s prior to the mand in order for the response to be considered accurate. This change in the definition of a correct mand response resulted in seven sessions in which all mands were prompted, before we saw a steady increase in independent mands (see Figure 8, 'Crying' panel). Acquisition of the mand response corresponded to decreases in levels of problem behavior, for Brian, including sessions with no problem behavior with each non-preferred stimulus. Although variable, there was a consistent decrease in levels of problem behavior as compared to baseline.

Levels of problem behavior for Jared were less variable, as compared to Brian, once he began to acquire the mand response for each stimulus. When we first introduced training with the dust buster, we saw an immediate decrease in the level of problem behavior, though levels did not decrease as much as we would have liked (Figure 7, third panel down). However, as training progressed across additional stimuli, we continued to see decreases in levels of problem behavior in the presence of all non-preferred stimuli. These results suggest that the training procedures may have produced a more generalized effect in decreasing levels of problem behavior. In addition, across sessions, problem behavior appeared greatly inflated, due to our measurement method; most instances of problem behavior lasted a maximum of 1 s, yet we scored occurrence within 10 s intervals.

For Jared, both problem behavior and mands were quite variable, with the hair clippers stimulus, following acquisition of the mand with the peer yelling stimulus (Figure 7, 4th & 5th panels down). Initially, we saw clear evidence of generalization of the mand response, with a corresponding decrease in problem behavior. Across the next eight sessions with the hair clippers stimulus, however, we observed levels of problem behavior and mands to vary from session to session. It is likely that this variability was due to the reinforcement contingencies in place; because these were baseline sessions, both problem behavior and mands were reinforced. Jared's pattern of responding suggests that both responses were established in his repertoire, and he needed the appropriate reinforcement contingencies in place to encourage mands for reinforcement rather than problem behavior. When training was implemented, Jared rapidly met the mastery criterion for the mand response and problem behavior dropped out completely across the last four of five training sessions. These results further support the idea that both responses were in Jared's repertoire; what was needed was the appropriate reinforcement contingencies. Although we did not systematically assess whether it was necessary to put problem behavior on extinction in conjunction with mand training, Jared's pattern of responding indicates that he may not have met the mastery criterion for acquisition of the mand (at least not as rapidly), if problem behavior continued to produce escape. Several other authors have found communication training to be ineffective when not paired with extinction for problem behavior (e.g., Hagopian et al., 1998; Kelley et al., 2002).

Limitations and Future Directions

This study extends previous research in that we confirmed a negative reinforcement function of problem behavior before we trained mands for negative reinforcement sequentially across stimuli until generalization occurred. There are, however, several limitations to the current study which might be addressed through additional research. First, only two participants completed all experimental procedures. We had multiple sources of within participant experimental control, with the inclusion of the no stimulus and preferred stimuli control conditions, and the sequential introduction of training using a multiple baseline design across stimuli. However, we are limited in the generality of our results, because both participants were diagnosed with autism and engaged in ear covering as their primary topography of problem behavior. Replication of these results with individuals with other diagnoses and topographies of problem behavior would extend the generality of our findings.

In addition, although only two participants completed all experimental procedures, an additional six participants began experimental procedures but discontinued participation at various points, for a variety of reasons (see Appendix F for a summary of discontinued participant information). One participant was discontinued for medical reasons unrelated to the study following caregiver completion of the NRRS. A second participant was discontinued after completion of three full series of the systematic non-preferred stimulus assessment. Although she engaged in frequent, intense aggressive and destructive behavior across the school day that appeared to be maintained by negative reinforcement, we were unable to identify stimuli which reliably produced problem behavior within the experimental context. There appeared to be additional contextual variables which controlled her problem behavior that we were unable to replicate in the experimental context, despite a number of modifications, including conducting research sessions in her classroom, with teaching staff who typically worked with her serving as therapists.

The remaining four participants were discontinued from the current study because they engaged in an appropriate mand for negative reinforcement at some point during our experimental procedures. These mands occurred despite caregiver report that none of the students had any type of appropriate mand for negative reinforcement in their current repertoire. One of the four participants was discontinued early on, following caregiver completion of the NRRS and observations. During observations, this participant did not engage in problem behavior during activities that were reported to "always" produce problem behavior. When I probed additional tasks with him that appeared to be non-preferred, he appropriately said, “no” while shaking his head. Although this participant reportedly never manded appropriately in the classroom, I had developed a rapport with him prior to the study, which appeared to effect his responding. A second participant was discontinued from this study following the fourth session of the nonpreferred stimulus assessment, which was the first session in which she engaged in problem behavior. She clearly stated, “All done, please” despite her parents and teacher reporting that she had never used an appropriate mand for negative reinforcement. In addition, we had observed her engaging in an extensive repertoire of problem behavior in the classroom that appeared to be escape-maintained (e.g., head-butting others, kicking the furniture and walls, pushing, ear covering, screaming, crying), without ever manding. The third participant was a 3-year-old diagnosed with autism who had very limited, but emerging vocal communication skills. He used several single words and two to three word phrases to communicate. During session 10 of the nonpreferred stimulus assessment, the stimulus (i.e., a hair dryer turned on and pointed away from the participant) appeared to be more aversive than the stimuli previously presented, based on the magnitude of his response. While engaging in problem behavior, the participant suddenly stated, “I want all done.” When we reported to his caregivers that we were discontinuing experimental procedures, they were very surprised and commented that they were unaware he knew how to make the request. Since these three participants had appropriate mands for negative reinforcement in their repertoires, they were not appropriate for further inclusion in this study. Anecdotal observations of these participants engaging in typical daily activities suggested that the appropriate reinforcement contingencies were not in place to encourage manding and discourage problem behavior to access escape from non-preferred stimuli. Therefore, for these participants, we met with teaching staff and/or caregivers to discuss discontinuation of reinforcement for problem behavior and facilitation of generalization of mand responses.

The final discontinued participant had completed all assessment procedures and more than 20 baseline sessions when he produced an appropriate mand for negative reinforcement. As depicted in Figure 9, using 10-min sessions, his nonpreferred stimulus assessment produced four stimuli with consistently short latencies to problem behavior across the two series. After we conducted more than 20 baseline sessions, each including one of the four stimuli identified as non-preferred through the assessment (i.e., letters, gloves, zipping, and typing), we were having difficulty establishing baseline levels of problem behavior with most stimuli (i.e., with all but the zipping task). Whereas the stimuli included in baseline and training sessions for the two completed participants were auditory and/or tactile stimuli, all of the stimuli for this participant consisted of task demands. It seemed that despite our efforts to progress through the curriculum for each task, he was acquiring skills which resulted in the tasks becoming less aversive. The difficulties we encountered with this participant suggest that, at least for some participants, our procedures may be more difficult to implement when the targeted training stimuli consist of demands. When the experimental procedures require exposing a participant to a certain task for multiple sessions, it may be expected that, at least for some participants, the task will become less aversive with increased exposure, which also includes prompting and acknowledgement of correct responding. Call et al. (2009) also provided evidence of the instability of tasks as negative reinforcers. For one participant, during their demand assessment to identify potential negative reinforcers, the first series produced no problem behavior across all tasks assessed. Within the next two series, however, a clear hierarchy of problem behavior was evident across the stimuli assessed. It would be interesting to know whether additional researchers have found similar instability in assessing demands as negative reinforcers. Perhaps demands have proven difficult to reliably establish as negative reinforcers, and this has contributed to the relative lack of research conducted on generalization of mands for negative reinforcement across tasks (see Durand & Carr, 1991, and Wacker et al., 2005, for exceptions).

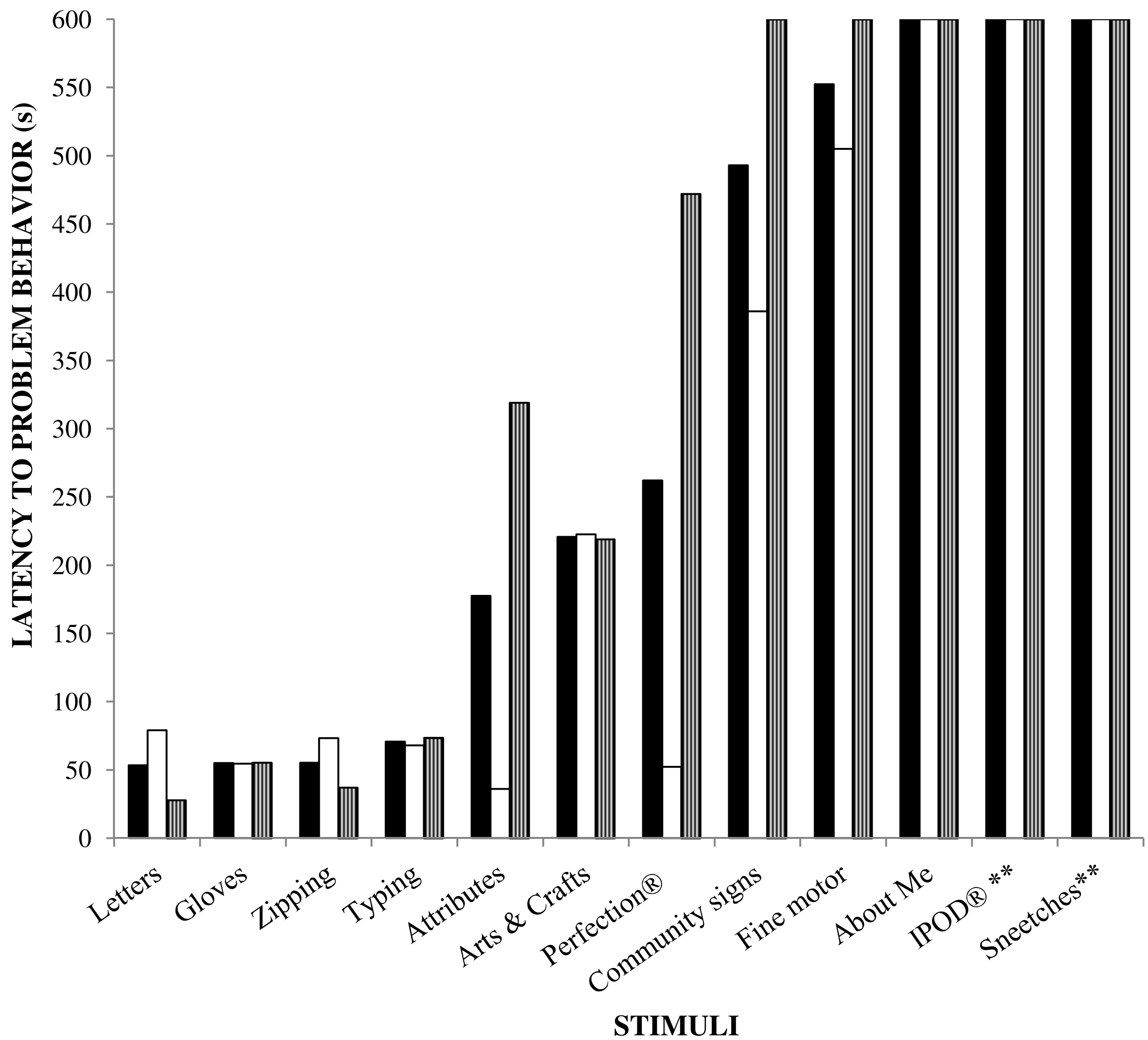

Figure 9. The non-preferred assessment results from our discontinued participant who we ran over 20 baseline sessions with before he manded for negative reinforcement. The black bar represents his average latency to problem behavior in the presence of each stimulus, across the two series conducted. The white bar represents his average latency to problem behavior during the first series. The striped bar represents his average latency to problem behavior during the second series. A * indicates the stimulus was identified as preferred during the paired stimulus preference assessment.

For this final discontinued participant, however, in the midst of trying to establish consistent levels of problem behavior during baseline, he suddenly signed "all done" during a session in which he was also engaging in problem behavior, resulting in escape from the task. Reportedly, this participant had learned the "all done" sign years ago, and it had not been observed at school or at home in years. Teachers had been attempting to teach the participant a "break" picture exchange response, but he had never used the response independently. Therefore, he had appeared to be an appropriate study participant. When he appropriately manded for negative reinforcement, however, we met with teaching staff, as we had done for the participants previously described, to discuss putting problem behavior on extinction and facilitating generalization of mand responses.

Our difficulty identifying participants who did not have an appropriate mand for negative reinforcement in their repertoire was unexpected. To avoid these same problems in the future, researchers looking to investigate establishing mands for negative reinforcement may benefit from employing more rigorous assessment procedures to determine whether participants are appropriate for inclusion in their research. These assessment procedures could include identifying (a) whether individuals' problem behavior hypothesized to be escape-maintained is currently being reinforced with escape, and (b) whether an appropriate mand for negative reinforcement has been established in the past, even if it is not currently seen in an individual's repertoire. If individuals' problem behavior is observed to result in escape, they may have a mand for negative reinforcement in their repertoire, but do not need to use it to access the reinforcer (i.e., escape). Similarly, if individuals have a history of engaging in an appropriate mand for negative reinforcement, it is possible that this response is still in their repertoire, even if the reinforcement contingencies currently in place are not sufficient for them to produce the response. In addition to more rigorous inclusion assessments perhaps being useful in the future, our identification of four participants who manded appropriately for negative reinforcement given a certain experimental context suggest that it would be beneficial to conduct additional research on methods of facilitating generalization of negatively reinforced mands to relevant contexts.

A second limitation to this study was that despite our interest in assessing generalization of responses across varied types of stimuli, we ended up with a fairly limited array of training stimuli, and a complete absence of task demands. Whereas Yi et al. (2006) and O'Neill and Sweetland-Baker (2001) selected stimuli from a narrow category for each participant (i.e., food items for two participants and toy instruments for one participant for Yi et al., and demands for O'Neill and Sweetland Baker), we included a wide variety of types of stimuli on the NRRS, and systematically assessed as broad a range of stimuli as was reasonable for each participant, based on NRRS results and observations. Although, for Brian, we assessed a variety of stimuli, and even conducted baseline sessions with three task demands in addition to the four auditory stimuli we ended up with, we were forced to discontinue sessions with the three tasks, because he stopped engaging in problem behavior with them. This left us with four auditory stimuli presented via an MP3 player. Jared's training stimuli were slightly more varied, including two auditory stimuli played via MP3 player (i.e., peer yelling and vacuum), a dust buster presented in person and turned on, and hair clippers, turned on and placed in contact with his head, non-blade side. Because we presented the actual items during the dust buster and hair clippers sessions, it is possible that there were visual and/or tactile components contributing to or responsible for the aversiveness of those stimuli. Because we did not evaluate the targeted stimuli to identify which features were aversive for Jared, we do not know which properties controlled his responding. Regardless, there was more variability in the type of stimuli presented to Jared, as compared to Brian. Because the types of stimuli used were still fairly limited for both participants, however, the generality of these results could be enhanced if future research included non-preferred stimuli from various modalities (e.g., olfactory, auditory, tactile), and then assessed generalization of the mand response across stimuli.

Although we purposefully included a variety of types of stimuli in our assessment and training procedures, inclusion of disparate stimuli in the non-preferred stimulus assessment could also be considered a study limitation. Specifically, while we included various tactile and auditory stimuli which were presented, for example, by placing an item in contact with the participant, or by playing the sound through speakers, we also included task demands. During demand sessions, we prompted participants using the standard three-step prompt hierarchy described by Iwata et al. (1982/1994), which included vocal prompt, model, and physical guidance, with praise provided for responding prior to guidance. Therefore, demand sessions included prompting, which was absent during assessment sessions with other types of stimuli. However, although this distinction exists between demands and other types of stimuli, perhaps it is unimportant for our purposes. Each demand complex includes many components. For example, a hair combing task includes components such as seeing a comb, feeling the comb in the hand, feeling the comb on the head, the vocal prompt to comb hair, the physical guidance to comb, and so forth. Although we do not know which component, or combination of components, of a demand is aversive to a participant, we do not know that about other types of stimuli either. For example, during sessions with the hair clippers, we turned them on and placed them in contact with Jared’s head, non-blade side. Components of stimulus presentation included the feeling of the hair clippers on his head, the sight of the hair clippers approaching his head, the buzzing sound the hair clippers made, the presence of another person moving their arm around his head, and so forth. Failing to identify which component(s) of stimulus presentation were aversive does not prohibit the stimulus complex from effectively functioning as a negative reinforcer during training sessions. Our goal was not to identify the exact source of negative reinforcement, but rather to identify for which stimulus complexes an escape function was reliable.

Another potential limitation of this study is that we only assessed one function of problem behavior. It is possible that problem behavior could have been multiply-maintained and our procedures did not identify the additional function. In fact, one possible explanation for the variability observed in Brian's levels of problem behavior was that in addition to an escape function, his behavior also accessed automatic reinforcement. We did not conduct enough 'no stimulus' control conditions to confirm whether problem behavior would persist in the absence of social contingencies, but it did occur during some sessions of both control conditions (see Figure 8). This hypothesis is also consistent with some of our informal observations. There were many times when ear covering occurred, for example, in the absence of a clear auditory stimulus preceding it. During mand training, however, as Brian acquired the response across stimuli, we saw a corresponding decrease in levels of problem behavior. This would tend to contradict the idea that the problem behavior was partially maintained by automatic reinforcement. In addition, looking across legs of the multiple baseline (see Figure 8), once the mand was acquired across stimuli, there were zero or near zero intervals of problem behavior across the last eight sessions. This is further evidence that the problem behavior may not have been multiply maintained. However, our data collection ended too soon after acquisition of the mand to know whether problem behavior would have persisted at a level that would necessitate further intervention. Given our assessment procedures, we cannot know with absolute certainty whether or not an automatic function was present in addition to the escape function for Brian's problem behavior. Future researchers should be aware that these procedures do not allow for confirmation of additional functions of problem behavior. If there is evidence suggestive of an automatic function for problem behavior, future researchers could conduct a series of extended alone sessions to either rule out or confirm the automatic function following the non-preferred stimulus assessment. If the problem behavior persists in the absence of social contingencies, additional treatment procedures could be implemented to address the automatic function. In addition, in future research, if the mand response were acquired and levels of problem behavior did not remain at a socially acceptable level, additional analyses could then be conducted to identify whether problem behavior served another function in need of treatment. In the current study, however, given that our purpose was to teach mands for negative reinforcement across stimuli, our assessment methods were appropriate for identification of multiple stimuli which served as negative reinforcers. In their review article on functional analysis of problem behavior, Hanley et al. (2003) stated that “assessment strategies that focus on single response-reinforcer relations may be beneficial under some conditions” (p. 177). They describe those conditions to include having anecdotal or descriptive information which are strongly suggestive of a particular source of influence. Caregiver completion of the NRRS and school observations provided us with information strongly suggestive of an escape function for problem behavior in the presence of various stimuli.

An additional limitation of our study consisted of the differing methods we used to measure mands and problem behavior. If Jared and Brian’s problem behavior had consisted only of discrete responses, we would have used frequency measures, converted to responses per minute, as we did with mand responses. However, since both participants engaged in non-discrete topographies of problem behavior (e.g., ear covering), we were forced to measure all topographies of problem behavior using 10 s partial interval recording procedures. Because mand responses were discrete, partial interval recording procedures would not have been an appropriate measurement method. Therefore, our multiple baseline graphs included double y-axes, displaying the percentage of intervals problem behavior on one axis, and the mand responses per minute on the other (see Figures 7 & 8). With disparate measurement procedures, we were not able to compare the levels of the two behaviors beyond the zero, non-zero relationships between them. Although this was not ideal, we felt it was our best measurement option. However, for both participants, the changes observed in both behaviors corresponded fairly well.

Another potential limitation of our study is that we selected a prompting procedure to teach the mand which may not be ideal for students who have a history of prompt dependence (i.e., waiting for the prompt to be provided). Researchers have documented the occurrence of prompt dependence when using delayed cue training procedures (e.g., Glat, Gould, Stoddard, & Sidman, 1994; Oppenheimer, Saunders, & Spradlin, 1993). In the current study, we employed a graduated guidance prompting procedure with a progressive prompt delay. At each prompt step, participant errors were interrupted with full physical guidance, and additional prompting was provided, as necessary, for the participant to complete the response. As the participant demonstrated independence, the delay to the prompt was increased in 5-s intervals, with a terminal delay of 30 s. We selected this prompting procedure to facilitate rapid acquisition of the mand response in participants who did not have a tendency toward prompt dependence. Neither of our participants had a noted history of prompt dependence, and the graduated guidance procedure with a progressive prompt delay proved to be an effective teaching procedure for both of them.

Prior to conducting our study, however, we recognized the possibility that this procedure may not be a suitable choice for students with a noted history of prompt dependence. We had planned to use a three-component backward chaining prompting procedure with a progressive prompt delay for students more likely to develop prompt dependence. The procedure would have consisted of us dividing a communication response into three components. For example, for a PECS response consisting of handing a communication card to the therapist, the three steps could be: (1) move hand towards communication card, (2) pick up card, and (3) give card to therapist. A backward chaining prompting procedure would have allowed the target for acquisition (e.g., giving the card to the therapist) to be smaller than the whole response (i.e., handing over the communication card), and prompting on each step could have been faded more rapidly, providing additional supports and opportunities for independence on small steps earlier on in training. It may be beneficial to conduct additional research exploring this, or similar, prompting procedures to teach mand responses to students with a noted history of prompt dependence.

One limitation of our study consisted of procedural integrity errors which stemmed from a definitional miscommunication between the therapist and researchers for Jared. For Jared, an appropriate mand was defined to include the absence of problem behavior (i.e., ear covering) in the 2 s prior to and just following the production of the “stop” sign. The mand was considered independent and accurate only if those criteria were met without the therapist making physical contact with Jared to prompt him. Due to a miscommunication, however, the therapist considered a mand to be independent and accurate if the sign was completed in the absence of physical prompts, regardless of whether or not prompts were required to begin the 2 s free of ear covering. Therefore, opportunities in which Jared's hands were guided away from his ears, but then he signed "stop" independently, were scored by the therapist as independent, accurate mands. This resulted in the prompt delay being increased for subsequent sessions, when it should not have been, according to our prompt prescription. In addition, these sessions were the first in which the therapist was delivering the prompt at an increased delay (i.e., beyond 3-5 s). During some sessions, if Jared began to emit the response, but ear covered within the 2-s window, the therapist intervened and prompted hands down for him to then produce the independent appropriate mand. This resulted in the therapist delivering prompts prior to the prescribed delay. These integrity errors were included in the calculations of overall integrity of implementation. As described in the Method section, for Jared, procedural integrity data were collected on 39% of sessions, and providing the prompt at the prescribed delay was implemented with 95% integrity (range, 0% to 100%). A sampling procedure was used such that 33% of sessions with inaccuracies in prompting were selected to be coded for Jared, since that was the sampling method employed across all other sessions. The sampling procedure consisted of placing the session numbers of sessions known to include integrity errors in a hat, and selecting one-third of those sessions to code.

Although overall levels of integrity were not detrimentally affected using our sampling procedures, the definitional miscommunication resulted in several variations from our prescribed procedures. First, the step prescription was inaccurate for several training sessions with both the dust buster and peer yelling stimuli, since the therapist determined whether or not the criteria to increase or decrease prompt steps was met based on a different definition of independence than intended. This resulted in four dust buster sessions being run at the incorrect delay (i.e., all at 5 s longer than should have been prescribed), and two peer yelling sessions being run at the incorrect delay (i.e., both at 10 s longer than should have been prescribed). When the miscommunication was discovered, the step prescription was altered so that the next sessions were run at the prescribed delay. Second, Jared manded with 100% independence and accuracy with the dust buster (i.e., the first training stimulus) for only one session, rather than the minimum of two sessions mastery criterion specified in our procedures, before training was introduced on the second stimulus (i.e., peer yelling).

As noted above, we scored the procedural integrity errors and included them in the overall integrity scores for this participant. Even with these errors, overall integrity scored on 39% of sessions was still a mean of 95%. In addition, we corrected the step prescription for subsequent sessions. We also conducted therapist re-training, such that prompts were no longer provided until the prescribed delay was reached. In addition, the therapist ensured that independent appropriate mands included 2 s free of problem behavior on each side of the "stop" sign. The therapist also began scoring a mand as prompted if she made physical contact with the participant at any point during the response. Despite the integrity errors described above, Jared was still acquiring the mand response, showing increased independence, with lower rates of problem behavior. As a result, once the integrity errors were addressed and problems documented, we progressed through training as planned.

In the current study, we were limited in the manner in which we presented the generalization probes in non-training environments, primarily due to the types of stimuli targeted during training. All four of Brian's training stimuli were auditory, presented via MP3 player during sessions. The specific stimuli consisted of an infant crying, people singing happy birthday, an alarm clock beeping, and audience applause. None of these stimuli were sounds that he would encounter on a daily basis in his classroom. Upon occasion, in Brian's classroom, teachers and classmates sang happy birthday to a student, and sometimes teachers and classmates would cheer and applaud the success of other students. However, crying infants were never present in the classroom, and alarm clocks were not used during the school day. Therefore, we presented probes of those stimuli via the MP3 player, though we did so without Brian seeing the electronic equipment.

Presenting some stimuli “live” and others via MP3 player, however, highlighted a training need that may otherwise have gone unnoticed. During post-training probes, when stimuli were presented via MP3 player, as they were in the experimental context, Brian produced the trained mand. When stimuli were presented “live” (e.g., a group of us singing “happy birthday”), Brian engaged in ear covering and did not produce the trained mand. Therefore, although Brian generalized the mand response across training stimuli, and to a non-training context when the stimuli were those that were used during training, he did not show evidence of generalization to a non-training context with stimuli which varied from those used during training. We did not assess whether Brian would mand if the “live” stimuli assessed in the non-training context were presented in the experimental context, because the goal was to promote generalization to the non-training context. In contrast, Jared showed strong evidence of generalization to a non-training environment, engaging in problem behavior in 20% of trials and using the trained mand in 87% of trials immediately post-training. However, all stimuli were presented as they were during training sessions for Jared. That is, the dust buster and hair clippers were physically present, and the peer yelling and vacuum stimuli were played via MP3 player. Therefore, we do not know whether Jared would have demonstrated the same lack of generalization during the non-training environment probes if the stimuli had been modified from those used during training. Taken together, these data suggest that, at least for some children, additional training may be necessary for the mand response to generalize across types of stimuli or properties of stimuli. Future researchers could explore strategies to facilitate generalization to a broader class of stimuli. For example, researchers could use multiple exemplars of stimuli during training sessions (e.g., three different recordings of different people singing happy birthday) to facilitate greater generalization of the mand response.

An additional potential limitation of this study is that the mand we taught was a non-specific response. Although a general response may be an appropriate starting point for children, such as our participants, who do not have any mands for negative reinforcement in their repertoire, a general mand is only a first step. More specific mands, such as "Turn off the alarm, please," or "Please don't sing happy birthday" are probably more likely to be reinforced than a general response such as signing "all done," since it is more likely that a listener may not know what the "all done" sign is in reference to. In addition, because the mand was trained across stimuli, and is an appropriate response in a variety of contexts, it is perhaps likely that several types of overgeneralization could occur. One type of overgeneralization could consist of overuse of the mand, with individuals requesting to stop all effortful activities and mildly unpleasant situations. In the current study, there was no evidence of either participant manding too frequently to be reasonably reinforced.

A second type of overgeneralization could consist of using the mand under inappropriate motivational control (e.g., to access positive reinforcers). There was some evidence of this occurring in the current study. On our social validity questionnaires, we asked parents and teachers whether they felt their child/student was using the mand response too frequently. Jared's teacher indicated that he was using it in place of signs for "help" and "more." Thus, Jared appeared to be using the mand to access positive reinforcement, not just negative reinforcement. That is, the mand appeared to be controlled by an overly wide range of motivating operations. To address this, we met with Jared's teacher to discuss procedures to gain tighter motivational control over the context in which he manded "stop."

A third type of overgeneralization could consist of a lack of appropriate stimulus control in the form of discriminating situations in which the mand is more (or less) likely to be reinforced. For example, an individual may mand for escape from activities such as taking medication or going to school, but the mand will not be reinforced because caregivers such as parents or teachers have decided that these activities should not be stopped. In the current study, there was some evidence of this type of overgeneralization during anecdotal observations of Jared post-training. When he was not feeling well, his teacher attempted to take his temperature. Although Jared appropriately signed "stop," his teacher continued holding the thermometer in his ear. In addition, Jared and Brian's teachers both indicated that they agreed somewhat that their student manded at times when they could not reinforce the response (e.g., when another student in the classroom was trantrumming). This concern was not indicative of overuse of the response, but rather, environmental events which made the mand response difficult to reinforce. To address these concerns, we met with both teachers to discuss ways in which the mand could be reinforced. For example, at times it may be possible to reinforce the mand by taking the student for a walk outside the noisy classroom environment. When this was not possible, perhaps the student could gain access to noise cancelling headphones or an MP3 player with ear buds in response to an appropriate mand.

Although there was no evidence of either participant manding too frequently to be reasonably reinforced, individuals who have been taught functional communication responses may mand too frequently or at times when the reinforcer cannot easily be delivered, as described above (Volkert, Lerman, Call, & Trosclair-Lasserre, 2009). If students are manding instead of engaging in problem behavior, but are effectively avoiding important activities (e.g., academic demands, taking medication), parents and teachers will not be satisfied (Tiger et al., 2008). There is a growing body of research investigating the most effective ways to thin the schedule of reinforcement when functional communication responses are occurring too frequently (see Hagopian, Boelter, and Jarmolowicz, 2011 for a review). In a recent example, Kuhn, Chirighin, & Zelenka (2010) trained participants to respond to naturally occurring discriminative stimuli. That is, for problem behavior maintained by attention, Kuhn et al. (2010) taught participants that in the presence of non-busy caregiver behavior (e.g., reading a magazine) their mand for attention would be reinforced, but in the presence of busy caregiver behavior (e.g., talking on the phone) their mand would not be reinforced. Future research could extend these procedures to negatively reinforced mands such as those acquired by the participants in this study. For example, in a noisy classroom environment, a student could be taught to mand for a walk to leave the classroom when they observe a teacher engaging in non-busy behavior (e.g., walking and observing the classroom), but to put headphones on when the teacher is engaged in busy behavior (e.g., interacting with another student).

Conclusions

Everyone, including individuals with disabilities, encounter stimuli they find aversive. People learn to respond in ways to decrease the aversiveness of situations. Sometimes the most effective way to decrease the aversiveness of a situation is to mand for someone else to remove the aversive stimulus (e.g., to turn off an alarm). Some children with developmental disabilities do not learn to mand for the removal of aversive stimuli without systematic training. Therefore, it is necessary to develop effective procedures to facilitate the acquisition of mands for negative reinforcement. Despite this need, as previously described, there is a relative lack of research on teaching mands for negative reinforcement, especially to escape non-demand stimuli. In addition, there is a relative lack of research on generalization of mands for negative reinforcement.

Prior to conducting this study, we spoke with educators who teach children with developmental disabilities regarding teaching a general mand for negative reinforcement. We sometimes encountered reservations about teaching such a general response. Teachers expressed concern that if their student were given an appropriate request to escape things they did not like, they might have difficulty getting the student to do anything. However, concern about overgeneralization of a mand response should not stop us from giving a child the means to appropriately request termination of non-preferred stimuli. Bannerman, Sheldon, Sherman, and Harchik (1990) authored an article on balancing the right to habilitation with the right to personal liberties. Within the article, they examined the advantages and disadvantages of allowing clients with developmental disabilities to exercise personal liberties such as the right to choose and refuse daily activities. As educators, we have an obligation to provide individuals with the necessary skills to refuse activities, as their abilities allow. A mand must be taught, along with teaching the child how to discriminate situations in which the request will be reinforced. The current study certainly did not achieve this end goal of teaching participants to discriminate the context in which their mands would be reinforced or not, nor was it designed to do so. We did, however, make some important contributions to the literature, which could facilitate future research achieving those goals. First, we employed systematic assessment procedures to identify non-preferred stimuli for use as negative reinforcers during mand training. Second, we confirmed a negative reinforcement function for problem behavior in the presence of the non-preferred stimuli targeted for training. Third, we employed control conditions during training to ensure that the mands were actually mands for negative reinforcement. Fourth, through the use of a multiple baseline design across stimuli, we demonstrated that training was required across multiple stimuli before generalization then occurred to untrained stimuli. And finally, we documented evidence of generalization of the mand response to a nontraining context. Perhaps as additional research is conducted on teaching mands for negative reinforcement, technologies will be developed and validated, and then become increasingly available to educators. It is our hope that the current study will lead to further research on the development of teaching procedures to replace problem behavior with mands for negative reinforcement, with the goal of influencing teaching procedures in the classroom so more children are given an appropriate way to control their environments.

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APPENDICES

Appendix A

Data Sheets

Paired-Stimulus Preference Assessment

Data collector: ______________________________ (circle one) Primary Reliability

Participant #: _________________________________ Date: _____________________

Stimuli

1		3		5		7	
2		4		6		8	

Circle participant's response or note if "no response" (NR)

Trial	Left	Right	NR	Correct arrangement Y/N	Trial	Left	Right	NR	Correct arrangement Y/N
1	1	2			**29**	2	1		
2	3	4			**30**	4	3		
3	5	6			**31**	6	5		
4	7	8			**32**	8	7		
5	2	3			**33**	3	2		
6	4	5			**34**	5	4		
7	8	2			**35**	2	8		
8	6	7			**36**	7	6		
9	3	1			**37**	1	3		
10	4	2			**38**	2	4		
11	7	5			**39**	5	7		
12	8	6			**40**	6	8		
13	5	3			**41**	3	5		
14	8	1			**42**	1	8		
15	6	4			**43**	4	6		
16	4	1			**44**	1	4		
17	2	5			**45**	5	2		
18	3	6			**46**	6	3		
19	4	7			**47**	7	4		
20	5	8			**48**	8	5		
21	1	5			**49**	5	1		
22	2	6			**50**	6	2		
23	3	7			**51**	7	3		
24	8	4			**52**	4	8		
25	6	1			**53**	1	6		
26	7	2			**54**	2	7		
27	8	3			**55**	3	8		
28	7	1			**56**	1	7		

Summary (enter number of times selected out of 14 opportunities)

1		*3*		*5*		*7*	
2		*4*		*6*		*8*	

Participant #: ____ Date: _____________

Data Collector: ____ Time: ____________

In Classroom: Putative Non-preferred Stimuli, Target Behaviors & Approximate Latency between Them

Stimuli	**Behavior(s)**	**Consequence(s)**	**Approximate Latency**
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	
____________ ____________	____________ ____________	__ The activity/event was Terminated __ Other________________	

Participant #: ___________________________________ Date: ______________________

Therapist: _____________________ Data Collector: ___________________ Primary/Reliability

Series #: _________ Session #: _______ Stimulus: ______________________________

Target Behavior #	Latency to Problem behavior		Procedural Integrity	
	Latency start (end of escape interval)	Latency end time (start of target bx)	Present stimulus w/in 3 sec of end of escape interval	Provide escape for each occurrence of target behavior(s)
1	:00		Session start:	
2				
3				
4				
5				
6				
7				
8				
9				
10				

Participant #: ___________________________________ Date: ______________________

Therapist: _____________________ Data Collector: ___________________ Primary/Reliability

Series #: _________ Session #: _______ Stimulus: ______________________________

Target Behavior #	Latency to Problem behavior		Procedural Integrity	
	Latency start (end of escape interval)	Latency end time (start of target bx)	Present stimulus w/in 3 sec of end of escape interval	Provide escape for each occurrence of target behavior(s)
1	:00		Session start:	
2				
3				
4				
5				
6				
7				
8				
9				
10				

Participant #: ____ Date: ____________

Data Collector: _____________________________________ Time: _______ Obs #: ______

Assessment in the Natural Environment:

Setting(s): ____

Opportunity	Stimulus Present	Problem Behavior(s) (topography)	Mand (topography: TR = trained, or describe)
1			
2			
3			
4			
5			

Participant #: ____ Date: ____________

Data Collector: _____________________________________ Time: ______ Obs #: ______

Assessment in the Natural Environment:

Setting(s): ____

Opportunity	Stimulus Present	Problem Behavior(s) (topography)	Mand (topography: TR = trained, or describe)
1			
2			
3			
4			
5			

Participant #: ___________________________________ Date: ______________________

Therapist: _____________________ Data Collector: ___________________ Primary/Reliability

Series #: ___ Session #: ___ Phase: BL/TR Condition: no/pref/non-pref Stimulus: ___________

Min	Interval	Problem Behavior **Interval / # (circle)**	Mands P / +	Procedural Integrity		
				Present stimulus w/in 3 sec of sess. start & end of escape interval	Provide correct prompt (TR) **Delay:** ________ **Type:** _________	Provide escape for prob bx (BL) or mand (BL&TR) (P or +)
0-1	:00-:09					
	:10-:19					
	:20-:29					
	:30-:39					
	:40-:49					
	:50-:59					
1-2	:00-:09					
	:10-:19					
	:20-:29					
	:30-:39					
	:40-:49					
	:50-:59					
2-3	:00-:09					
	:10-:19					
	:20-:29					
	:30-:39					
	:40-:49					
	:50-:59					
3-4	:00-:09					
	:10-:19					
	:20-:29					
	:30-:39					
	:40-:49					
	:50-:59					
4-5	:00-:09					
	:10-:19					
	:20-:29					
	:30-:39					
	:40-:49					
	:50-:59					

Appendix B

Problem Behavior Definitions

Table 1

Jared's problem behavior definitions

Ear covering	Using one or both hands, a shoulder, or a bicep placed over one or both ears. Includes folding ears over, sticking fingers in ears, placing hands flat over ears, or placing shoulder up against ear. Does not include flicking fingers against ears, running fingers around curves of ears, or covering ear with hand while head is resting on hand or arm and elbow is resting on table or other surface (unless hand, bicep, or shoulder is used to cover other ear). Does not include scratching ear (i.e., visible scratching motion with one or multiple hands).
Crying / whining	Grimacing paired with inappropriate, non-contextual vocalizations which include moans and/or whimpers. May or may not include tears. Does not include facial tensing paired with non-contextual vocalizations.

Table 2

Brian's problem behavior definitions

Ear covering	Using one or both hands, a shoulder, or a bicep placed over one or both ears. Includes folding ears over, sticking fingers in ears, placing hands flat over ears, or placing shoulder up against ear. Does not include flicking fingers against ears or running fingers around curves of ears.
Head to object/knee	Making direct contact with head and an object (e.g., desk) or his knee from a distance of 2 in or greater. Also included placing one hand or arm on the object or his knee and then hitting against the hand/arm from a distance of 2 in or greater.
Hand to head/neck	Making direct contact with an open or closed hand against head or neck from 3 in or greater. Also includes placing one hand or arm against hand or neck and hitting that hand with the other hand from a distance of 3 in or greater.
Hand to body	Making forceful contact with an open or closed hand or hands and his torso (i.e., side, stomach) or leg(s) from a distance of 6 in or greater. Includes using one or two hands simultaneously, *not* hitting with two hands in alternation.
Hand to object	Making forceful contact with an open or closed hand and an object (e.g., the wall, desk) from a distance of 6 in or greater.
Swiping / pushing items	Pushing items forcefully across desk /table.
Throwing items	Throwing an object through the air at someone or something.

Appendix C

Negative Reinforcement Rating Scale

Participant #: ____ Date: _____________

Relationship of Respondent to Participant: ____

Please use the following scale to rate whether you think the activity is something your child/student would want to avoid:					
	1 Does not bother child at all	2 Sometimes bothers child	3 Often bothers child	4 Always bothers child	DK Don't know
When other people make certain noises (e.g., clapping, crying, singing) **Specify noises:**	1	2	3	4	DK
When a toy or other item makes a certain noise (e.g., sirens, alarm clock, toy, radio) **Specify items & noises:**	1	2	3	4	DK
When there is a certain odor (e.g., dinner cooking, perfume) **Specify odors:**	1	2	3	4	DK
When touching something in particular (e.g., sand, finger paints, felt cloth) **Specify items:**	1	2	3	4	DK
When making contact with another person (e.g., giving a hand shake, giving a high-5) **Specify types of contact:**	1	2	3	4	DK
When in close proximity to other people (e.g., standing in line, sitting on a bench) **Specify situations:**	1	2	3	4	DK
Doing self-care tasks independently (e.g., combing hair, changing clothes) **Specify tasks:**	1	2	3	4	DK
When being helped in self-care tasks (e.g., hand washing) **Specify tasks:**	1	2	3	4	DK
Doing school work (at home and school) **Specify tasks/topics:**	1	2	3	4	DK
Doing work around the house **Specify tasks:**	1	2	3	4	DK
Going from one area/activity to another (transitioning) **Specify area/activity:**	1	2	3	4	DK
Doing work (of any kind) that is very difficult **Specify tasks:**	1	2	3	4	DK
Doing work that requires a lot of steps **Specify tasks:**	1	2	3	4	DK
Remaining in seat (or sitting still) for a long period (e.g. in a waiting room, at dinner table)	1	2	3	4	DK
When in pain or uncomfortable	1	2	3	4	DK
When the room/area is noisy	1	2	3	4	DK
When the room/area is crowded	1	2	3	4	DK
When unable to understand or hear people (e.g., because of visual/hearing impairment)	1	2	3	4	DK
Any other situations:	1	2	3	4	DK

Appendix D

Sequence of Experimental Sessions

Table 1

Sequence of Experimental Sessions for Jared

	Condition					
	Non-preferred stimuli				Controls	
Session	Dust buster	Peer yelling	Hair clippers	Vacuum	No stimulus	Preferred
1					X	
2	X					
3				X		
4						X
5		X				
6			X			
7				X		
8					X	
9	X					
10						X
11			X			
12		X				
13	X					
14					X	
15				X		
16						X
17	X					
18			X			
19		X				
20	X					
21				X		
22					X	
23		X				
24	X					
25	X					
26	X					
27		X				
28						X
29	X					
30			X			
31	X					
32	X					
33	X					
34				X		
35	X					
36	X					
37		X				
38					X	
39	X					
40	X					
41	X					

(continued)

	Condition					
	Non-preferred stimuli				Controls	
Session	Dust buster	Peer yelling	Hair clippers	Vacuum	No stimulus	Preferred
42	X					
43			X			
44	X					
45	X					
46						X
47	X					
48	X					
49	X					
50	X					
51		X				
52				X		
53	X					
54					X	
55		X				
56		X				
57		X				
58			X			
59		X				
60	X					
61						X
62		X				
63		X				
64					X	
65				X		
66		X				
67		X				
68	X					
69			X			
70				X		
71		X				
72	X					
73						X
74			X			
75				X		
76		X				
77	X					
78					X	
79				X		
80			X			
81	X					
82						X
83			X			
84				X		
85			X			
86		X				

(continued)

Session	Condition: Non-preferred stimuli: Dust buster	Peer yelling	Hair clippers	Vacuum	Controls: No stimulus	Preferred
87	X					
88			X			
89			X			
90			X			
91		X				
92					X	
93				X		
94						X
95			X			
96			X			
97			X			
98	X					
99				X		
100			X			
101			X			
102			X			
103		X				
104				X		
105			X			
106			X			

Note. grey = training

Table 2

Sequence of Experimental Sessions for Brian

	Condition					
		Non-preferred stimuli			Controls	
Session	Crying	Happy birthday	Alarm clock	Applause	No stimulus	Preferred
1					X	
2		X				
3			X			
4	X					
5						X
6				X		
7	X					
8						X
9		X				
10					X	
11			X			
12				X		
13						X
14					X	
15	X					
16			X			
17				X		
18		X				
19					X	
20						X
21	X					
22	X					
23	X					
24		X				
25			X			
26	X					
27	X					
28				X		
29	X					
30	X					
31	X					
32	X					
33		X				
34					X	
35						X
36	X					
37	X					
38	X					
39			X			
40	X					
41	X					

(continued)

	Condition					
		Non-preferred stimuli			Controls	
Session	Crying	Happy birthday	Alarm clock	Applause	No stimulus	Preferred
42	X					
43				X		
44		X				
45	X					
46					X	
47	X					
48	X					
49	X					
50	X					
51						X
52	X					
53	X					
54	X					
55	X					
56	X					
57	X					
58	X					
59			X			
60	X					
61	X					
62	X					
63	X			X		
64		X				
65	X					
66	X					
67					X	
68						X
69		X				
70		X				
71			X			
72		X				
73		X				
74		X				
75				X		
76			X			
77	X					
78					X	
79						X
80				X		
81			X			
82		X				
83				X		
84			X			
85				X		
86			X			

(continued)

	Condition					
		Non-preferred stimuli			Controls	
Session	Crying	Happy birthday	Alarm clock	Applause	No stimulus	Preferred
87				X		
88			X			
89					X	
90						X
91	X					
92		X				
93			X			
94			X			
95			X			
96			X			
97			X			
98				X		
99				X		
100	X					
101		X				
102						X
103					X	

Note. grey = training

Appendix E

Social Validity Questionnaire

Participant #: ____ Date: ______________

Relationship of Respondent to Participant: ____

Please use the following scale to rate whether you agree or disagree with the following statements:					
1 Disagree completely	2 Disagree somewhat	3 Neither agree nor disagree	4 Agree somewhat	5 Agree Completely	
I think it is important for my child /student to learn how to appropriately communicate that they do not like/want something. **Comments:**	1	2	3	4	5
I think my child/student benefited from participating in this research. **Comments:**	1	2	3	4	5
I have seen my child/student appropriately use the new request they have learned, outside of experimental sessions. **Comments:**	1	2	3	4	5
I think my child/student engages in less problem behaviors than they used to, before participating in this research, when they encounter things they don't like. **Comments:**	1	2	3	4	5
I think my child/student is using the new request too frequently. **Comments:**	1	2	3	4	5
My child/student has used the new request at times when I cannot grant it (e.g., when it's time to get on the bus). **Comments:**	1	2	3	4	5
Please include any additional comments or questions that you have: ____________________ ____________________ ____________________ ____________________ ____________________					

Appendix F

Discontinued Participant Information

Table 1

Discontinued participants: Phase and rationale

Participant	Discontinuation	
	Phase	Rationale
1	NRRS and observations completed	Medical reasons unrelated to the study
2	Non-preferred stimulus assessment completed	Failure to identify stimuli which reliably produced problem behavior
3	NRRS and observations completed	Participant manded for negative reinforcement
4	Non-preferred stimulus assessment	Participant manded for negative reinforcement
5	Non-preferred stimulus assessment	Participant manded for negative reinforcement
6	Baseline	Participant manded for negative reinforcement

CURRICULUM VITAE

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2012 (anticipated)	Doctor of Philosophy in Disability Disciplines, Applied Behavior Analysis Specialization *Utah State University*, Logan, UT Dissertation: Generalization of Negatively Reinforced Mands in Children with Developmental Disabilities Co-Advisors: Timothy A. Slocum, Ph.D. & Sarah E. Bloom, Ph.D., BCBA-D
2004	Advanced Training Program (Post-master's program in Applied Behavior Analysis) *Northeastern University*, Boston, MA
2003	Master of Science in Education *Simmons College*, Boston, MA
2000	Bachelor of Arts in Psychology, Magna Cum Laude *Fairfield University*, Fairfield, CT

PROFESSIONAL CERTIFICATION/LICENSURE

Board Certified Behavior Analyst (BCBA™), Certification Number: 1-05-2249
First Certified: 6/30/2005 Recertification Date 6/30/2014

Teacher of Students with Severe Disabilities (Levels: All), Professional License Issued in the Commonwealth of Massachusetts, Certification Number: 386080
Issued: 11/6/2003

PUBLICATIONS

Groskreutz, N. C., Karsina, A., Miguel, C. F., & Groskreutz, M. P. (2010). Using Complex Auditory-Visual Samples to Produce Emergent Relations in Children with Autism. *Journal of Applied Behavior Analysis, 43,* 131-136.

Groskreutz, M. P., Groskreutz, N. C., & Higbee, T. S. (2011). Response competition and stimulus preference in the treatment of automatically reinforced behavior: A comparison. *Journal of Applied Behavior Analysis, 44,* 211-215.

Groskreutz, N. C., Groskreutz, M. P., & Higbee, T. S. (2011). Effects of varied levels of treatment integrity on appropriate toy manipulation in children with autism. *Research in Autism Spectrum Disorders, 5,* 1358-1369.

MANUSCRIPTS IN PREPARATION

Groskreutz, N. C., & Slocum, T. A. (2012). The importance of treatment integrity for practitioners. (manuscript in preparation).

Groskreutz, M. P., Groskreutz, N. C., Peters, A. & Higbee, T. S. (2012). Teaching children with autism spectrum disorders to make naturally cued social comments during play activities. (*manuscript in preparation).*

Groskreutz, M. P., Groskreutz, N. C., Wintle, P. & Higbee, T. S. (2012). Comparison of time delay and spatially faded prompts in preschoolers with autism. *(manuscript in preparation).*

ONGOING RESEARCH

Groskreutz, N. C., Groskreutz, M. P., Bloom, S. E., & Slocum, S. A. (2012). Generalization of negatively reinforced mands in children with developmental disabilities.

Groskreutz, M. P., Groskreutz, N. C., & Collins, S. (2012). Evaluation of interresponse time as a measure during functional analyses.

INVITED PRESENTATION

Groskreutz, N. C., & Spencer, T. D. (2009, October). *Social communication and job skills of adults with autism: Assessment strategies, teaching procedures, and evidence base*. Presentation at the annual Vocational Rehabilitation Statewide In-service. Boise, ID.

CONFERENCE PRESENTATIONS

Groskreutz, N. C., Groskreutz, M. P., Bloom, S. E., & Slocum, T. A. (2012, March). *Teaching children with autism to generalize negatively-reinforced mands*. Paper presented in a Symposium at the 8th Annual Connecticut Applied Behavior Analysis Conference. Cromwell, CT.

Groskreutz, M. P., Slocum, T. A., & Groskreutz, N. C. (2012, March). *Examining behavioral momentum theory in applied settings: Translations and challenges*. Paper presented in a Symposium at the 8th Annual Connecticut Behavior Analysis Conference. Cromwell, CT.

Groskreutz, N. C., & Slocum, T. A. (2010, May). *Examining the role of treatment integrity for practitioners.* Paper presented in a Symposium at the 36th Annual Association for

Behavior Analysis International Convention. San Antonio, TX.

Groskreutz, M. P., Slocum, T. A., & Groskreutz, N. C. (2010, May). *A translational study examining behavioral momentum and context in children with autism.* Paper presented in a Symposium at the 36th Annual Association for Behavior Analysis International Convention. San Antonio, TX.

Groskreutz, N. C., Groskreutz, M. P., Wintle, P., & Higbee, T. S. (2010, March). *A comparison of temporally and spatially faded prompting procedures in children with autism spectrum disorders.* Paper presented in a Symposium at the Utah State University 2010 Graduate Student Symposium. Logan, UT.

Groskreutz, N. C., & Slocum, T. A. (2010, February). *The importance of treatment integrity for practitioners.* Address given at the 2010 CalABA Conference. Irvine, CA.

Groskreutz, M. P., Groskreutz, N. C., & Higbee, T. S. (2009, May). *Application of script-fading procedures to teach naturally cued social comments during play activities.* Symposium at the 35th Annual Association for Behavior Analysis International Convention. Phoenix, AZ.

Groskreutz, N. C., Groskreutz, M. P., & Higbee, T. S. (2009, March). *A comparison of temporally and spatially faded prompting procedures for children with autism spectrum disorders*. Symposium at the 2009 CalABA Conference. Burlingame, CA.

Groskreutz, M. P., Groskreutz, N. C., & Higbee, T. S. (2009, March). *Teaching children with autism spectrum disorders to make naturally cued social comments during play activities*. Symposium at the 2009 CalABA Conference. Burlingame, CA.

Groskreutz, N. C., & Spencer, T. D. (2008, June). *Applied behavior analysis and autism: A primer for employment specialists.* Presentation at the 6th annual Utah Conference on Effective Practices in Special Education and Rehabilitation: Interventions across the Lifespan. Logan, UT.

Groskreutz, N. C., Groskreutz, M. P., & Higbee, T. S. (2008, May). *Effects of varying levels of treatment integrity on appropriate toy manipulation in children with autism.* Symposium at the 34th Annual Association for Behavior Analysis International Convention. Chicago, IL.

Groskreutz, N. C., Higbee, T. S., & Groskreutz, M. P. (2008, February). *An analysis of various levels of treatment integrity on interventions to increase play skills in young children with autism*. Symposium at the 2008 CalABA Conference. Garden Grove, CA.

Andrade, M., Braga-Kenyon, P. R., Groskreutz, N., Miguel, C., Trimmer, S., & McDermott, E. (2006, May). *Teaching auditory-visual matching-to-sample: A comparison between point prompt delay and no delay for point prompt procedures.* Symposium at the 32nd Annual Association for Behavior Analysis Convention. Atlanta, GA.

Groskreutz, N.C., Karsina, A.J., Miguel, C., & Groskreutz, M.P. (2006, May). *The effects of using complex auditory-visual samples on equivalence class formation.* Symposium at the 32nd Annual Association for Behavior Analysis Convention. Atlanta, GA.

Magnusson, A. F., Groskreutz, N. C., & Miguel, C. (2006, May) *An attempt to establish auditory-visual conditional discrimination in children with autism.* Poster presented at the 32nd Annual Association for Behavior Analysis Convention. Atlanta, GA.

Rooker, G., Roscoe, E. M., Ervin, D., & Groskreutz, N. (2006, May*). Differential reinforcement of alternative behavior with and without stimulus fading for escape-maintained problem behavior.* Symposium at the 32nd Annual Association for Behavior Analysis Convention. Atlanta, GA.

Andrade, M., Braga-Kenyon, P., Groskreutz, N., Miguel, C., McDermott, E., & Trimmer, S. (2005, October). *Teaching auditory-visual matching-to-sample: A comparison between point prompt delay and no delay for point prompt procedures.* Symposium at the 26th Annual Berkshire Association for Behavior Analysts and Therapists (BABAT) Conference. Amherst, MA.

Groskreutz, N. C., Karsina, A. J., Miguel, C., & Groskreutz, M. P. (2005, October). *Using compound auditory-visual samples to increase learning efficiency within match-to-sample trials*. Symposium at the 26th Annual Berkshire Association for Behavior Analysts and Therapists (BABAT) Conference. Amherst, MA.

Magnusson, A., Groskreutz, N., & Miguel, C. (2005, October). *An attempt to establish auditory-visual conditional discrimination in children with autism.* Symposium at the 26th Annual Berkshire Association for Behavior Analysts and Therapists (BABAT) Conference. Amherst, MA.

Rooker, G. W., Roscoe, E. M., Groskreutz, N., & Ervin, D. (2005, October). *Differential reinforcement of alternative behavior with and without demand fading for escape-maintained problem behavior.* Symposium at the 26th Annual Berkshire Association for Behavior Analysts and Therapists (BABAT) Conference. Amherst, MA.

Rooker, G., Roscoe, E. M., Ervin, D., & Groskreutz, N. C. (2005, May). *Differential reinforcement with and without stimulus fading for escape-maintained problem behavior*. Poster presented at the 31st Annual Association for Behavior Analysis Convention. Chicago, IL.

Groskreutz, N. C., Rooker, G. W., Roscoe, E. M., Thomason, J. L., Iwata, B. A., & Neider, P. L. (2004, October). *An evaluation of latency as the index of problem behavior during functional analysis*. Poster presented at the 25th Annual Berkshire Association for Behavior Analysts and Therapists (BABAT) Conference. Amherst, MA.

PROFESSIONAL EXPERIENCE

2010-2011 **Behavioral Consultant**
Connecticut Behavioral Health, LLC, Cheshire, CT
Collaborated with public school personnel in two districts to conduct

functional assessments, and develop behavior intervention plans. Met with families, trained staff on implementation, monitored progress, and made programming revisions.

2008-2009 **Behavioral Consultant**
Bear River Activity and Skills Center (BRASC), Logan, UT
Conducted behavioral assessments, developed behavior support plans, trained staff on implementation, monitored progress, and made programming revisions, as needed, for adults with disabilities.

2007-2008 **BACB Fieldwork and Practicum Experience Supervisor**
Cache County, Utah
Supervised Cache County School District Behavior Specialist for practicum experience toward BCBA requirements. Conducted observations in public school classrooms, met with supervisee, teachers, and other school personnel, conducted supervision meetings, provided feedback on written behavior plans, and lead discussion of relevant readings.

2007-2008 **Behavior Analyst**
Chrysalis, Inc., Logan UT
Consulted to a family, providing support for behavioral, self-help, social, and community skills programming for a teenage girl with Down Syndrome. Wrote and managed monthly progress reports for Chrysalis residents.

2006-2007 **Supervisor and Case Manager**
Autism Services: Education, Research and Training (ASSERT) Program Logan, UT
Supervised instructors working with children with autism, created curriculum and oversaw programming. Documented and tracked students' progress, conducted parent and staff trainings, worked and trained in-home with parents, and created individual behavior plans for home and school. Consulted with additional families on challenging behavior and academic deficits.

2005-2006 **Program Specialist, Residential Program – Staff Intensive Unit**
The New England Center for Children, Southborough, MA
Developed and supervised behavioral and educational interventions for children with severe special needs in a residential school setting, according to the principles of Applied Behavior Analysis. Conducted behavioral assessments. Developed Individualized Education Plans, behavioral guidelines, and self-help and social skills curriculum. Trained and supervised a team of 20 teachers in effective implementation of behavioral guidelines, educational programs, and data collection.

2004-2005 **Curriculum Specialist, ACE® Department**
The New England Center for Children, Southborough, MA
Developed the Autism Curriculum Encyclopedia (ACE®) – a comprehensive resource for developing and individualizing curriculum

based on Individualized Education Plans. Responsibilities included all aspects of design, appearance, function, and implementation of the ACE.

2004-2005 **Alternate Assessment Specialist**
The New England Center for Children, Southborough, MA
Supervised and directed Program Specialists in the development of alternate assessment portfolios. Responsible for the submission of New York, New Jersey, and Massachusetts portfolios.

2003-2004 **Curriculum Development Coordinator, Residential Program – Staff Intensive Unit**
The New England Center for Children, Southborough, MA
Developed and supervised the implementation of all academic curriculum for 26 students with intensive special needs. Collaborated in the development of Individualized Education Plans, and completed educational assessments. Created and modified skill acquisition curriculum to address skills outlined in the Massachusetts Curriculum Frameworks. Developed MA and NY alternate assessment portfolios. Supervised teachers in implementation of curriculum and data summary.

2002-2003 **Day Coordinator, Residential Program – Staff Intensive Unit**
The New England Center for Children, Southborough, MA
Developed daily staff and student schedules to ensure safe and effective teacher-student environments. Conducted and documented ongoing training and observation of staff. Monitored and evaluated progress in student educational and clinical programs. Supervised classroom programming and organization of educational materials. Collaborated in the development and oversaw the implementation of student educational plans.

2001-2002 **Case Manager, Staff Intensive Unit**
The New England Center for Children, Southborough, MA
Assisted in the completion of behavioral assessments, and development of behavior management guidelines for case student under the supervision of Program Specialist. Collaborated in the development of educational plans. Wrote quarterly progress reports and clinical case reviews evaluating student progress. Charted student educational and behavioral progress. Communicated weekly with student's family regarding current performance and concerns.

2000-2002 **Level 2 Teacher, Staff intensive Unit**
The New England Center for Children, Southborough MA
Instructed students with developmental disabilities under the supervision of a Board Certified Behavior Analyst.

<u>TEACHING EXPERIENCE</u>

Spring 2008 **Instructor – Undergraduate & Master's Level Course: Applied Behavior Analysis II: Applications**
Utah State University, Logan, UT

Prepared and gave weekly class lectures, prepared and organized in-class group activities, supervised creation and implementation of behavior intervention plans, observed students implementing behavior intervention plans in public school classrooms, participated in weekly planning meetings, graded assignments, held office hours, and met with students, as needed.

Fall 2007 — **Teaching Assistant – Undergraduate & Master's Level Course: Applied Behavior Analysis I: Principles, Assessment, and Analysis**
Utah State University, Logan, UT
Supervised creation and implementation of behavior intervention plans, observed students implementing behavior intervention plans in public school classrooms, participated in weekly planning meetings, graded assignments, held office hours, and met with students, as needed.

Spring 2007 — **Teaching Assistant – Undergraduate Course: Assistive and Adaptive Technology for Persons with Disabilities**
Utah State University, Logan, UT
Updated lectures and assignments, gave several class lectures, graded all assignments, held office hours, and met with students, as needed.

1999-2000 — **Teaching Assistant – Undergraduate Course: Statistics of the Life Sciences**
Fairfield University, Fairfield, CT
Assisted professor in teaching undergraduate psychology and neuropsychology students, including provision of instruction during weekly lab sessions.

ACADEMIC APPOINTMENTS

2008-2009 — **Utah State University Student Teaching Supervisor**
Utah State University, Logan, UT
Supervised student teacher in the completion of certification requirements, teaching experience, and portfolio completion toward a Bachelor's degree in Special Education and Severe Special Needs Teaching Licensure.

Summer 2006 — **Northeastern University Personalized System of Instruction Developer**
Northeastern University, Boston, MA
Developed a personalized system of instruction based on Cooper, Heron, and Heward's 1987 text *Applied Behavior Analysis,* to facilitate master's students' development of verbal skills necessary to become fluent in the language of Applied Behavior Analysis, incorporating interview and oral test components.

Summer 2006 — **Simmons College Writing and Educational Support Services**
Simmons College, Boston, MA
Provided writing and academic support to students in the Masters program in Severe Special Needs, including individual weekly meetings, providing strategies and scheduling components of larger writing assignments.

2004-2006	**Simmons College Supervising Practitioner** Simmons College, Boston, MA Supervised 3 practicum students in the completion of certification requirements, clinical experience, and coursework toward a Master of Science in Education and Severe Special Needs Teaching Licensure.
2004-2005	**Northeastern University Academic Tutor** Northeastern University, Boston, MA Assist student pursuing a Master of Science in Applied Behavior Analysis with coursework.

EDITORIAL EXPERIENCE

2012	Guest Reviewer, *Research in Developmental Disabilities*
2009-2012	Proposal Reviewer, *Council for Exceptional Children (CEC) Conference*
2008	Guest Reviewer, *Education and Treatment of Children*
2007	Guest Reviewer, *Education and Treatment of Children*
2006	Guest Reviewer, *Journal of Applied Behavior Analysis*

GRANT EXPERIENCE

Agency:	U.S. Department of Education
Role:	Graduate Assistant
Purpose:	To develop a vocational rehabilitation service model for individuals with Autism Spectrum Disorders – a project through Disability Rehabilitation Research Projects (DRRPs).
Proposed Duration:	October 1, 2008-September 30, 2013
Amount:	$350,000 per year – Not funded

PROFESSIONAL ORGANIZATION MEMBERSHIP

2004-Present	Association for Behavior Analysis International
2008-Present	Association of Professional Behavior Analysts
2010-Present	Berkshire Association for Behavior Analysis and Therapy
2010-Present	Connecticut Association of Behavior Analysis
2007-2010	California Association for Behavior Analysis
2008-2010	Four Corners Association for Behavior Analysis
2009-2010	Association of Utah Behavior Analysts
2008-2009	Council for Exceptional Children

INSTITUTIONAL SERVICE

2006-present	Attendee, T. Shahan / A. Odum lab, Experimental Analysis of Behavior Psychology Department, Utah State University
2006-2009	Attendee, T. Higbee Research Meeting Special Education and Rehabilitation Department, Utah State University
2007-2008	Association for Behavior Analysis Program Representative Special Education and Rehabilitation Department, Utah State University
2005-2006	Member, Peer Review Group The New England Center for Children, Southborough, MA
2004-2006	Member, Stimulus Control Lab The New England Center for Children, Southborough, MA
2004-2006	Member, Behavioral Treatment Research Group The New England Center for Children, Southborough, MA

2004-2006	Member, Discrimination Curriculum Development Group The New England Center for Children, Southborough, MA
2003-2005	Member, Massachusetts Alternate Assessment Committee The New England Center for Children, Southborough, MA

HONORS

2009	Graduate Student Senate travel award
2008	SABA Student Presenter Grant for the ABAI annual convention
2006-2007	Presidential Fellowship at Utah State University - $12,000
2001	Employee of the month at The New England Center for Children
2000-2001	New England Psych Association Honorary Undergraduate Fellows Award
1999-2000	Phi Beta Kappa National Honor Society
1999	National Science Foundation grant recipient to conduct research in the Neuropsychology and Human Development Laboratory, University of South Carolina, Columbia, SC.