Journal of
Applied Behavior Analysis
JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2015, **48,** 563–574 NUMBER 3 (FALL)

A COMPARISON OF POSITIVE AND NEGATIVE REINFORCEMENT FOR COMPLIANCE TO TREAT PROBLEM BEHAVIOR MAINTAINED BY ESCAPE

SARAH K. SLOCUM AND TIMOTHY R. VOLLMER

UNIVERSITY OF FLORIDA

Previous research has shown that problem behavior maintained by escape can be treated using positive reinforcement. In the current study, we directly compared functional (escape) and nonfunctional (edible) reinforcers in the treatment of escape-maintained problem behavior for 5 subjects. In the first treatment, compliance produced a break from instructions. In the second treatment, compliance produced a small edible item. Neither treatment included escape extinction. Results suggested that the delivery of a positive reinforcer for compliance was effective for treating escape-maintained problem behavior for all 5 subjects, and the delivery of escape for compliance was ineffective for 3 of the 5 subjects. Implications and future directions related to the use of positive reinforcers in the treatment of escape behavior are discussed.

Key words: autism, compliance, differential reinforcement, escape behavior

---

Functional analysis methodology has led to an increase in the use of function-based treatments rather than arbitrarily selected treatments (Pelios, Morren, Tesch, & Axelrod, 1999). Typically, results of the functional analysis provide information for developing a treatment that both weakens the relation between problem behavior and its maintaining consequences and strengthens the relation between appropriate behavior and those same consequences (Mace, 1994). Function-based treatments have been developed for both socially reinforced behavior (e.g., Carr & Durand, 1985; Lalli, Casey, & Kates, 1995; Vollmer, Marcus, & Ringdahl, 1995) and automatically reinforced behavior (e.g., Fisher, Lindauer, Alterson, & Thompson, 1998; McCord, Grosser, Iwata, & Powers, 2005; Reid, Parson, Phillips, & Green, 1993). These treatments frequently involve using the reinforcer that had previously maintained problem behavior to subsequently strengthen appropriate behavior, such as communication or compliance.

Escape-maintained problem behavior is commonly treated with noncontingent escape (NCE; Vollmer et al., 1995), differential reinforcement (DR; Carr & Durand, 1985; Lalli et al., 1995), or escape extinction (EE; Iwata, Pace, Cowdery, & Miltenberger, 1994). Although a potential intervention itself, EE is often used in conjunction with other procedures. Previous research suggests that extinction is sometimes a necessary component for treatment of escape behavior to be maximally effective (e.g., Fisher et al., 1993; Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998; Patel, Piazza, Martinez, Volkert, & Santana, 2002; Shirley, Iwata, Kahng, Mazaleski, & Lerman, 1997). However, the use of EE has several limitations, including the potential necessity of physical guidance in the context of three-step prompting. Physical guidance might be undesirable in some cases, or perhaps dangerous or impossible (e.g., in cases in which the subject is larger or stronger than practitioners or family members). In response to these limitations, researchers have sought to develop classes of alternative interventions that do not require physical interaction.

A portion of this research was conducted with support from the Autism Speaks' Dennis Weatherstone Predoctoral Fellowship 9166, Sarah Slocum, principal investigator.

Address correspondence to Timothy R. Vollmer, Psychology Department, University of Florida, Gainesville, Florida 32611 (e-mail: vollmera@ufl.edu).

doi: 10.1002/jaba.216

One unique characteristic to the treatment of behavior maintained by escape from demands is that an inherent competing alternative behavior (compliance) might covary with problem behavior (Parrish, Cataldo, Kolko, Neef, & Egel, 1986). Results of previous studies show that contingent delivery of positive reinforcers for compliance (Carter, 2010; Lalli & Casey, 1996; Lalli et al., 1999; Mevers, Fisher, Kelley, & Frederick, 2014; Piazza et al., 1997) and noncontingent delivery of positive reinforcers (Lomas, Fisher, & Kelley, 2010) can effectively decrease problem behavior and simultaneously increase levels of compliance. Lalli and Casey (1996) found that problem behavior was likely influenced by multiple variables (e.g., the introduction of a task and the removal of appetitive activities) for a young boy with developmental delays. Treatment was most effective when experimenters delivered praise, toys, a break from demands, and social interaction contingent on compliance. These results suggest that positive reinforcement for compliance might produce shifts in response allocation despite the continued availability of escape for problem behavior. Results of this study occasioned a line of research that evaluated the conditions under which reinforcing compliance might treat negatively reinforced problem behavior while the contingency for problem behavior is maintained (i.e., negative reinforcement).

Piazza et al. (1997) compared the effects of positive and negative reinforcement with and without extinction on escape-maintained behavior. Three subjects' functional analysis results suggested that problem behavior was maintained by both negative and positive reinforcement. The introduction of a break contingent on compliance (without extinction for problem behavior) increased compliance and decreased problem behavior for one participant. The addition of positive reinforcement contingent on compliance resulted in a more immediate suppression of problem behavior for that subject as well as for a second subject. Finally, extinction for problem behavior was necessary to produce high levels of compliance and low levels of problem behavior for the third participant. Piazza et al. demonstrated that the addition of a tangible item during a period of escape was more effective than escape alone when EE was excluded as a treatment component. That being said, it is possible that positive reinforcers alone (i.e., without escape) would have been effective at reducing problem behavior.

To date, Lalli et al. (1999) and Carter (2010) have conducted the most direct comparisons of contingent positive and contingent negative reinforcement in the treatment of escape behavior without EE. In both studies, experimenters taught individuals with escape-maintained problem behavior to comply with instructions by providing either an edible item or a break contingent on compliance. Problem behavior resulted in escape throughout both evaluations. Across subjects, positive reinforcement was more effective at decreasing problem behavior and increasing compliance with task demands compared to negative reinforcement.

Nonetheless, some questions remain unanswered. First, in both the Piazza et al. (1997) and Lalli et al. (1999) studies, subjects experienced demands every 30 s rather than continuously. Lalli et al. also used 10-s interprompt intervals in the least-to-most prompting hierarchy. These prompting arrangements might compromise interpretation of the data because the prompting strategies themselves included brief breaks from instructions. Brief breaks within the broad instructional context might have contributed to decreased motivation to access breaks (abolishing operation) and abated escape-related responding. The extent to which brief breaks influenced responding in these arrangements is an empirical question. Control of the intertrial intervals (i.e., minimizing breaks from instructions that are not a part of the formal manipulation of the independent variable) is a reasonable step in the progression of comparing positive and negative reinforcement for treating escape-maintained problem behavior. Second, both Lalli et al. and Carter (2010) primarily used reversal designs.

Reliance on one type of design might compromise data interpretation (e.g., carryover effects might not occur as readily in alternative designs; Payne & Dozier, 2013). For example, for Jay (Lalli et al.), negative reinforcement contingencies were effective for treating problem behavior only when the positive reinforcement condition preceded the negative reinforcement condition.

The use of positive reinforcement to treat problem behavior maintained by escape offers potential benefits (Payne & Dozier, 2013). The delivery of positive reinforcers for appropriate behavior might be less disruptive to classroom or daily routines compared to providing escape for appropriate behavior. Teachers or practitioners might prefer to deliver a small edible item or token for compliance rather than a break. It is likely that the use of positive reinforcers also would influence the establishing operation for escape during aversive stimulation. If positive reinforcers attenuate the aversive qualities of the demand context, escape behavior might be less likely to occur.

Previous research that has demonstrated the efficacy of positive reinforcement to treat escape-maintained problem behavior without the use of EE holds great promise for application (e.g., Carter, 2010; Lalli & Casey, 1996; Lalli et al., 1999; Piazza et al., 1997). However, additional systematic research that directly compares positive and negative reinforcement for compliance while some of the previously discussed variables are controlled is warranted. In the current study, we sought to extend previous research by comparing positive reinforcement for compliance and negative reinforcement for compliance in the absence of EE while treating problem behavior maintained by escape from demands.

METHOD

Subjects and Setting

Subjects had been referred to the Behavior Analysis Research Clinic located on the University of Florida's campus or attended a local school for individuals with disabilities. The first five individuals (four boys and one girl, ranging in age from 4 to 8 years), whose functional analyses showed problem behavior maintained by escape, participated in this study. Braiden was a 4-year-old boy who, based on school records, had been diagnosed with an autism spectrum disorder (ASD). He communicated with gestures and a few modified words. He also followed some single-step instructions. Ali was a 7-year-old girl who had been diagnosed with ASD by a credentialed assessor using the Autism Diagnostic Observation Schedule (ADOS). She also had been diagnosed with ASD, attention deficit hyperactivity disorder, and oppositional defiant disorder by a personal physician. She spoke in multiword sentences and followed complex two-to three-step instructions. Nicholas was an 8-year-old boy who had been diagnosed with pervasive developmental disorder not otherwise specified by a personal physician and also through an ADOS assessment conducted by the aforementioned assessor. He spoke in short sentences and followed two-step instructions. Stephen was a 7-year-old boy who had been diagnosed with ASD by a personal physician. He could not speak vocally but used a few sign approximations to communicate his needs. He followed some single-step instructions. Milo was a 4-year-old boy who had been diagnosed with a developmental delay based on his school records. He did not have any functional communication and did not follow simple instructions at the start of this evaluation.

Experimenters conducted sessions either in a small pullout room (2 m by 2 m) at a local school or in a session room (3 m by 4 m) in a clinic. In both environments, session rooms were equipped with a one-way observation panel for research assistants to collect data unobtrusively. Experimenters conducted Milo's sessions in an area (3 m by 3 m) of a larger room that was blocked off to mitigate high levels of loud vocal stereotypy. The session room (or area) was empty except for items (e.g., edible items or instructional materials) needed to conduct the sessions as described below.

Response Definitions and Interobserver Agreement

The operational definitions for each subject's problem behavior are presented in Table 1. Braiden engaged in aggression (e.g., hitting, kicking, biting, and scratching) and spitting. Ali's target behavior consisted of vocal protests, a precursor behavior for more severe aggression. When the assessment was initiated, she produced loud whining vocal protests (e.g., "No, I don't want to!"). Her family and clinical staff agreed to focus on this precursor behavior to avoid dangerous aggression that typically occurred following the vocal protests. Nicholas displayed aggression in the form of hitting, pushing, kicking, scratching, grabbing, spitting, and hair pulling. Stephen's aggression included grabbing, hair pulling, and pinching. Milo's aggression took the form of pushing, climbing on others, and hitting. Due to the severity of the aggression across subjects, experimenters attempted to block instances that might have harmed the experimenter (e.g., a blow to the head). It is important to note that throughout the functional analysis, baseline, and treatment conditions, any blocked attempt was scored as an instance of problem behavior. Compliance was scored if the subject engaged in the topographically correct response following either a vocal or a model-plus-vocal prompt (see prompting sequence described below).

Interobserver agreement was scored using a proportional agreement method. Within each 10-s interval, the smaller number of observed instances was divided by the larger number of observed instances and converted to a percentage. If both observers recorded no behavior in a given 10-s interval, an agreement of 100% was scored for that interval. Finally, the percentages for each interval were added and divided by the number of intervals to produce an average in each session. Agreement data were collected across 58% (Braiden), 38% (Ali), 26% (Nicolas), 26% (Stephen), and 58% (Milo) of sessions and averaged 96% (range, 73% to 100%) for Braiden, 96% (range, 74% to 100%) for Ali, 94% (range, 61% to 100%) for Nicolas, 97% (range, 74% to 100%) for Stephen, and 96% (range, 74% to 100%) for Milo.

Table 1
Operational Definitions for the Topographies of Problem Behavior

Behavior	Subjects	Definition
Hitting	Braiden, Nicholas, Milo	Forceful contact of the subject's hand to another person from 6 in. or more.
Kicking	Braiden, Nicholas	Forceful contact of the subject's foot to another person from 6 in. or more.
Biting	Braiden, Nicholas	Closure of the subject's teeth around the skin or clothes of another person.
Scratching	Braiden, Nicholas, Stephen	Contact and subsequent movement of a minimum of 2 in. of the subject's fingernails along the experimenter's skin or clothes; each hand constitutes a separate instance of the behavior.
Spitting	Braiden, Nicholas	Expulsion of the subject's saliva in the direction of another person.
Hair pulling	Nicholas, Stephen	Closure of the subject's hand and subsequent pulling of the experimenter's hair.
Pinching	Nicholas, Stephen	Closure of the subject's thumb and pointer finger around the experimenter's skin or clothes.
Grabbing	Nicholas, Stephen	Closure of the subject's entire hand around the experimenter's skin or clothes excluding the experimenter's hand because some subjects use that as a communicative response (i.e., leading the experimenter).
Pushing	Nicholas, Milo	Placement of one or two hands on the experimenter followed by an attempt to forcefully displace the experimenter.
Vocal protest	Ali	Any vocal statement regarding not completing a task. These all began with the word "no." A separate instance was scored if the vocal protest stopped for 3 s before resuming again.
Climbing on others	Milo	Getting on the experimenter's back with all four limbs not making contact with the floor.

Procedure

Functional analysis. Before the treatment comparison, we conducted a functional analysis of problem behavior with each of the five subjects. Sessions lasted 5 min and were based on the procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). Not all subjects were exposed to all conditions. Anecdotal evidence of behavioral function influenced the selection of conditions. For example, if a caregiver suggested that problem behavior occurred often when preferred items were delayed or denied, the functional analysis included a tangible condition. Based on those reports, we selected some or all of the following conditions to include in a multi-element functional analysis. The sessions conducted for each individual are displayed in each subject's functional analysis graph (Figure 1).

In the no-interaction condition, the subject and experimenter were in the session room with no other materials. The experimenter did not engage with the subject or provide any programmed consequences for problem behavior. During the attention condition, the experimenter sat in the session room with materials (e.g., a book). The subject had continuous access to a moderately preferred tangible item (determined previously by a paired-stimulus preference assessment [PSPA]; Fisher et al., 1992). The session began with the experimenter saying, "I have some work to do; play with your toy." Contingent on any instance of problem behavior, the experimenter provided attention in the form of a brief reprimand (e.g., "Don't do that," "That hurts; ouch!" "I really don't like that.").

Before the start of tangible sessions, the subjects briefly interacted with leisure or edible items. The experimenter removed the item from the subject's possession to start the session. Contingent on problem behavior, the experimenter provided 20 to 30 s of access to the item for leisure items or a single piece of an edible item. We used edible items in the tangible condition for Braiden and Milo and a leisure

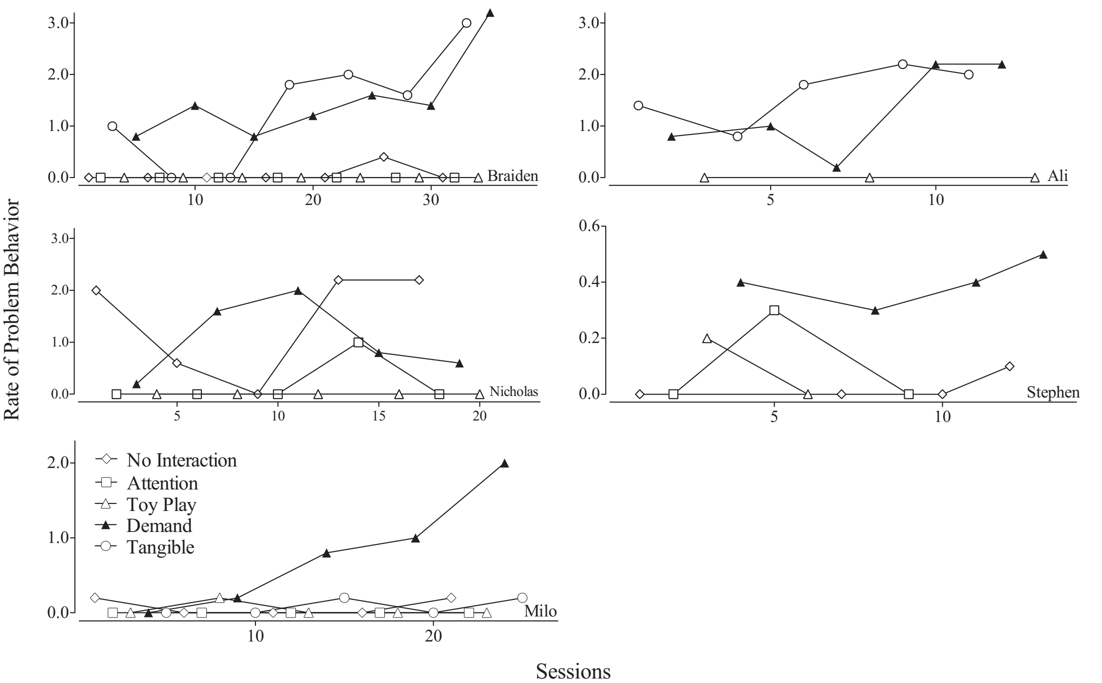

Figure 1. The rate of problem behavior during functional analysis conditions for each subject.

item for Ali. These items were selected based on parent and teacher reports as to what was typically delivered following problem behavior. For Braiden and Milo, teachers reported that they sometimes delivered edible items contingent on problem behavior because of those subjects' limited vocal repertoires (i.e., the teachers reported that those subjects did not have alternative appropriate communicative responses in their repertoires). For Ali, her father reported that he occasionally delivered leisure items to "calm her down." During play sessions (control), experimenters provided continuous access to a highly preferred tangible item (determined by a PSPA; Fisher et al., 1992) and continuous access to attention from the experimenter. No demands were placed, and no consequences were provided for problem behavior.

Finally, we identified appropriate instructions to be used during the demand condition of this analysis based on parent or teacher report or by direct observation of the subject during instructional situations. The experimenter delivered instructions continuously throughout these sessions. Regardless of the type of instruction, a three-step least-to-most prompting procedure was used in which instruction began with a vocal prompt. After an incorrect response or no response, the experimenter again provided a verbal prompt to complete an instruction and modeled the correct behavior. The experimenter issued brief praise contingent on correct responding after a vocal or model-plus-vocal prompt. Contingent on an incorrect response or no response, the experimenter repeated the vocal prompt and physically guided the subject to complete the instruction. Incorrect or no responses (within 3 s of an instruction) produced advancement through the prompting hierarchy. Experimenters issued instructions immediately after a physical prompt, thus limiting the amount of escape throughout these sessions. If problem behavior occurred at any point during instruction, the experimenter provided 30 s of escape. Problem behavior that occurred during the escape period did not produce programmed consequences.

We chose different demands for each subject. For subjects for whom sessions took place in the local school, the experimenter selected tasks that were in the subjects' current repertoires. For subjects for whom sessions were conducted in the clinic, the demands were selected based on new skill-acquisition programs. For example, experimenters issued an array of simple gross-motor instructions and imitation instructions (e.g., "touch your nose," "clap," "raise your hands") to Braiden, Stephen, and Nicholas. Nicholas's instructions also included selecting picture cards from an array of two cards (e.g., "touch the bird"). Ali's tasks included math worksheets with addition and subtraction problems. Milo's instructions consisted of four one-step instructions (i.e., "clap," "sit down," "stand up," and "give me a high five").

We interpreted the functional analysis and treatment-comparison data using standard visual-inspection procedures. A group of four or more behavior analysts examined the data to make a determination regarding behavioral function. Subjects whose functional analysis results suggested that problem behavior was maintained at least in part by negative reinforcement in the form of escape were eligible to participate in the treatment comparison.

Treatment comparison. We compared two treatments using a reversal design embedded within a multielement design. The 5-min sessions included distinct discriminative stimuli (i.e., colored T-shirts) to assist in discrimination between conditions (Conners et al., 2000). The demands included those used in the functional analysis demand condition for all subjects, with the exception of Ali. Ali's father reported that problem behavior related to instructions to pick up toys required intervention in the home.

Baseline. The baseline phase was identical to the demand condition of the functional analyses described above, with one exception. We incorporated a 3-s intertrial interval (ITI) between instructions to control for delivery time in the positive reinforcement condition described below (i.e., to equate the ITI in each condition).

Positive reinforcement. This condition differed from baseline in one way. Contingent on compliance, the experimenter delivered a small edible item that was selected based on verbal reports from the subject's teacher or parent. Experimenters delivered edible items, and not leisure items, because consumption of edible items did not compete with ongoing instructions or compliance. A new instruction was issued after 3 s regardless of whether the subject had completely consumed a previously delivered item, which produced the same ITI as in baseline. We used varied edible items for Braiden, Stephen, Ali, and Milo and only one edible item for Nicholas (per his request). These items included salty (e.g., pieces of potato chip), sweet (e.g., small pieces of chocolate), and liquid (e.g., juice) snacks. For subjects whose functional analysis data suggested sensitivity to positive reinforcement in the form of access to tangible items (i.e., edible items), one of the items delivered in the functional analysis was used in this phase (along with other items). Problem behavior continued to produce a 30-s break. Experimenters thinned the schedule of reinforcement from a fixed-ratio (FR) 1 to a variable-ratio (VR) 10 during Ali's second treatment comparison.

Negative reinforcement. This condition differed from baseline in one way. The experimenter delivered a 30-s break contingent on compliance (problem behavior continued to produce 30 s of escape).

RESULTS

Figure 1 displays problem behavior for each subject during the functional analyses. Across all subjects, problem behavior was maintained by negative reinforcement in the form of escape from instructions (Nicholas, Stephen, and Milo) or by both escape and access to tangible items (Braiden and Ali). Treatment data are depicted for each subject in Figure 2. For Braiden (top), levels of problem behavior were high and variable in baseline. Problem behavior remained at low or zero levels in the positive reinforcement condition. Problem behavior remained at lower levels in the first phase of the negative reinforcement condition compared to baseline; however, problem behavior remained at baseline levels in the second phase of the negative reinforcement condition. Braiden never engaged in high levels of compliance, although he engaged in more compliance in the positive reinforcement condition than in the negative reinforcement condition. For Ali (second panels from the top), levels of problem behavior were high and stable in both baseline phases. Problem behavior remained at low or zero levels in the positive reinforcement condition and at baseline levels in the negative reinforcement condition. Ali engaged in high and stable levels of compliance in the positive reinforcement condition and rarely engaged in compliance in the negative reinforcement condition.

Nicholas's (middle) and Stephen's (fourth panels from the top) levels of problem behavior were variable in both baseline phases. Problem behavior decreased in both the positive and negative reinforcement phases towards the end of the treatment-comparison phases. Both subjects showed larger reductions in problem behavior in the positive reinforcement condition relative to the negative reinforcement condition; however, both subjects engaged in similar levels of compliance in the two treatment conditions.

For Milo (bottom), levels of problem behavior were higher in the first baseline phase than in the second baseline phase. Problem behavior decreased in both the positive and negative reinforcement conditions in the first treatment-comparison phase compared to the first baseline phase. Problem behavior remained at low levels in the second phase of the positive

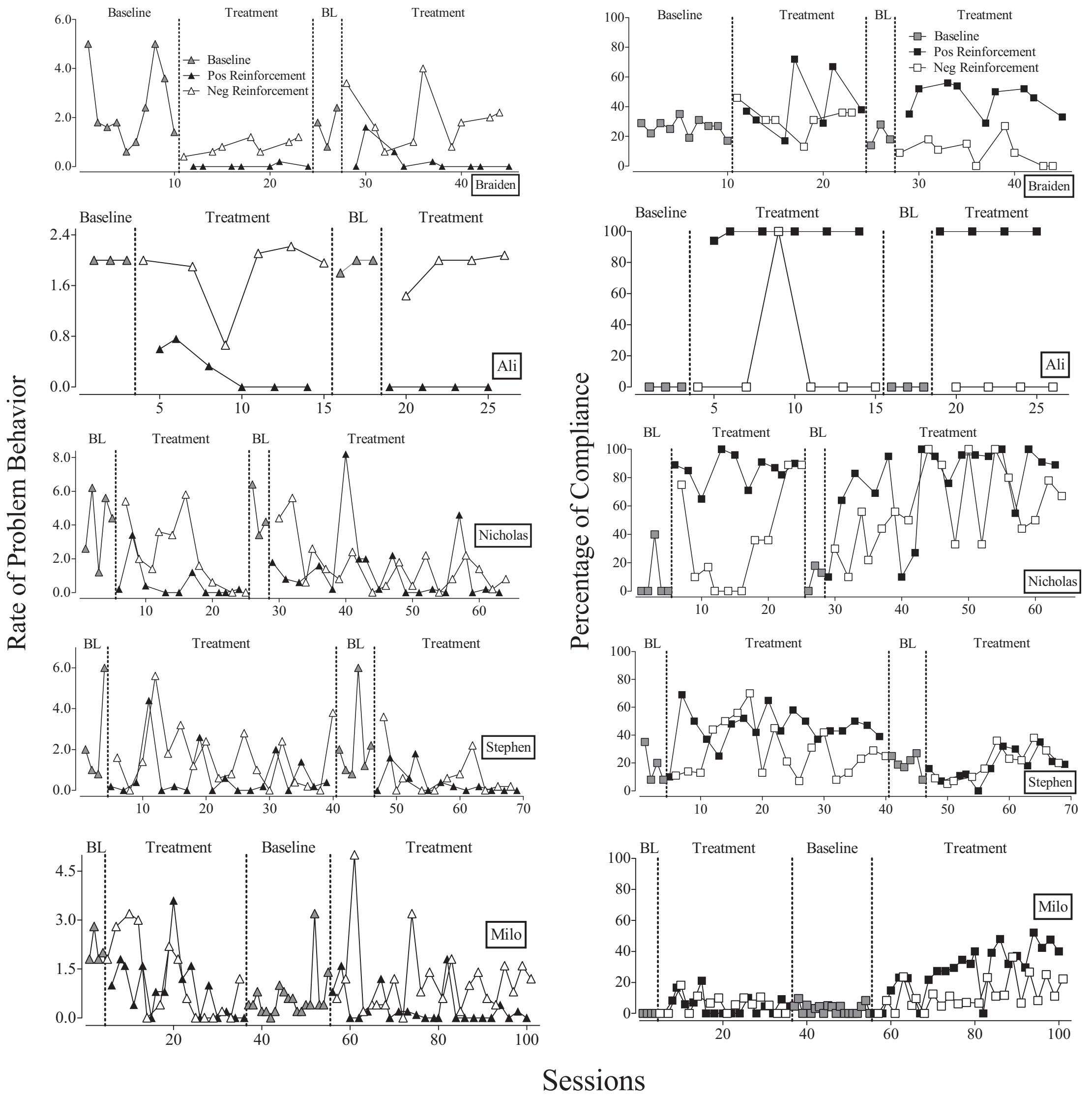

Figure 2. The rate of problem behavior during baseline and treatment conditions for each subject (left) and the percentage of compliance during baseline and treatment conditions for each subject (right) across sessions.

reinforcement condition and at baseline levels in the second phase of the negative reinforcement condition. Milo's compliance increased only in the second treatment-comparison phase and more so in the positive reinforcement condition than in the negative reinforcement condition.

Across the five subjects, the average rate of problem behavior was 2.4 in baseline, 0.5 in positive reinforcement, and 1.3 in negative reinforcement. Collectively, problem behavior was reduced by 79% from baseline in the positive reinforcement condition and 48% from baseline in the negative reinforcement condition. Similarly, levels of compliance were different in the positive reinforcement condition compared to the negative reinforcement condition. The average percentage of compliance was 11.0% in baseline, whereas compliance averaged 54.8% and 22.8% in the positive and negative reinforcement conditions, respectively.

DISCUSSION

Positive reinforcement in the form of contingent access to edible items produced decreases in problem behavior for all subjects. Only two subjects (Nicholas and Stephen) showed a decrease in problem behavior in the negative reinforcement condition relative to baseline. Compliance increased for all five subjects in the positive reinforcement condition. For two subjects (Braiden and Stephen), compliance increased moderately; for the other three subjects (Ali, Nicholas, and Milo), the positive reinforcement condition resulted in large gains in the levels of compliance compared to the baseline condition. Milo and Nicholas showed an increase in compliance in negative reinforcement compared to baseline. Yet, both subjects' levels of compliance were higher in positive reinforcement than in negative reinforcement conditions.

Further, positive reinforcement resulted in near-zero levels of problem behavior by the end of the treatment-comparison phases, but this was not the case for the negative reinforcement condition. For two subjects, (Ali and Braiden), those decreases in problem behavior were socially significant (i.e., 90% reduction in problem behavior). For two subjects (Nicholas and Milo), the positive reinforcement treatment required extended exposure to the contingencies before problem behavior was reduced and compliance increased, perhaps due to carryover effects or difficulty with discriminating between conditions due to use of the multielement design. Providing the functional reinforcer (escape) for compliance in the negative reinforcement condition was effective for only two subjects (Nicholas and Stephen).

Despite recent empirical attention to the role of positive reinforcement for treating behavior maintained by negative reinforcement, the mechanism by which positive reinforcers decrease problem behavior remains largely unknown (Payne & Dozier, 2013). It is possible that the delivery of edible items functions as an abolishing operation and reduces the aversive quality of the demand context and the evocative effect of the instructions. This hypothesis is supported in work conducted by Lomas et al. (2010) who showed that noncontingent delivery of edible items was effective in decreasing levels of problem behavior. On the other hand, positive reinforcers might simply be more preferred than other types of reinforcers (DeLeon, Iwata, & Roscoe, 1997; Lalli et al., 1999). Thus, when positive and negative reinforcers are placed in direct competition, positive reinforcers might support compliance over negative reinforcement.

The delivery of edible items might be particularly effective because these items are not often delivered throughout an individual's day, whereas it is likely that breaks are provided often (i.e., an open vs. closed economy). Finally, the delivery of negative reinforcers for compliance might have competed less effectively with escape-maintained problem behavior because both problem behavior and compliance became members of the same response class. In the negative reinforcement condition, the same reinforcer was provided for both problem behavior and compliance. It is possible that problem behavior remained within baseline levels because of the simultaneous strengthening of responses that are in the same response class (Catania, 1998).

It is important to note that although other studies have examined the utility of positive reinforcers to treat behavior maintained by negative reinforcement, the current study is the first to compare the two treatments with rapidly alternating conditions in the context of a multielement design. In addition, previous studies that have compared the use of positive and negative reinforcement for compliance without the use of EE primarily used reversal designs that might have resulted in sequence or carryover effects (Carter, 2010; Lalli et al., 1999). The use of a multielement design in our study allowed clear differentiation in responding across the two simultaneously conducted treatment conditions.

These data have several implications for clinicians. We suppressed problem behavior for every subject using edible reinforcers without extinction. Extinction can be difficult to implement due to the potential negative side effects (e.g., extinction bursts). Further, the use of EE is not possible in some cases (e.g., when individuals are larger or stronger than clinicians or caregivers). In contrast to the use of extinction, the procedures in the current study are relatively easy for a teacher or parent to implement. Further, the subjects received more instructions in the positive reinforcement condition, thus increasing the number of learning opportunities. For example, in Braiden's evaluation, the experimenter delivered an average of 25 and 12 instructions in the positive reinforcement and negative reinforcement conditions, respectively. This effect might have produced positive outcomes for Milo, who showed more rapid acquisition during positive reinforcement.

The current evaluation included several limitations. Functional analysis results for Braiden and Ali, the two subjects who showed the clearest results favoring the positive reinforcement condition, included evidence of problem behavior maintained by positive reinforcement in the form of access to tangible items. Therefore, the positive reinforcers we used might not have been entirely nonfunctional in relation to the function of problem behavior. The tangible condition was not included in Stephen's and Nicolas's functional analyses. It is possible that individuals whose functional analyses show both tangible and escape functions might be more responsive to the positive reinforcement condition when behavior maintained by negative reinforcement is treated. Conversely, individuals whose problem behavior is not sensitive to positive reinforcement in the form of access to tangible items might not be as responsive to treatment of negatively reinforced problem behavior with edible items. Future researchers should specifically examine the extent to which the identification of a positive reinforcement function increases the probability of positive reinforcers competing with negative reinforcement contingences.

One participant (Milo) had very low levels of compliance in the first treatment-comparison phase. Milo did appear to attempt to cooperate with instructions, but his limited receptive language skills interfered with his ability to meet the operational definitions established for this study. For example, when the experimenter asked him to touch his head and even modeled that behavior, he often pointed to the experimenter's hand. By the second treatment comparison, he appeared to be acquiring some responses, as represented by the increase in compliance for those sessions. Because his level of compliance was so low, we also calculated the trials in which no problem behavior occurred or trials in which he tolerated the instruction (i.e., the percentage of instructions that produced neither aggression nor compliance). Milo did not engage in problem behavior for 10.6% of trials in the first phase of baseline, 80.4% of trials in the first positive reinforcement condition, and 74.3% of trials in the first negative reinforcement condition. When we conducted the reversal, Milo displayed no problem behavior for 89.1% of trials in baseline, 93.1% of trials in positive reinforcement, and 76.2% in negative reinforcement. These results suggest that Milo's compliance might have become increasingly sensitive to the positive reinforcement contingency as his responding came under the discriminative control of the specific instructions.

Another potential limitation includes the limited duration of our sessions (5 min). Longer sessions (and thus more exposure to the edible items) might have produced satiation and compromised the extent to which these items were effective for treating problem behavior maintained by negative reinforcement. Thus, the extent to which these results are robust across time is unknown. Finally, we did not test for generalization to other settings, situations, or instructions. Overall, providing positive reinforcement for compliance yielded reductions in problem behavior and increased compliance displayed by individuals with escape-maintained problem behavior. In at least some cases, this procedure can be effective without the need for EE, a procedure that is at times dangerous or not feasible. From a clinical perspective, the positive reinforcement procedure seems to be feasible and reliable as a treatment for problem behavior maintained by escape. Future research should more closely evaluate the mechanisms responsible for the effectiveness of positive reinforcement to treat problem behavior and compliance.

REFERENCES

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, *18*, 111–126. doi: 10.1901/jaba.1985.18-111

Carter, S. L. (2010). A comparison of various forms of reinforcement with and without extinction as treatment for escape-maintained problem behavior. *Journal of Applied Behavior Analysis*, *43*, 543–546. doi: 10.1901/jaba.2010.43-543

Catania, A. C. (1998). *Learning* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Conners, J., Iwata, B. A., Kahng, S. W., Hanley, G. P., Worsdell, A. S., & Thompson, R. H. (2000). Differential responding in the presence and absence of discriminative stimuli during multielement functional analyses. *Journal of Applied Behavior Analysis*, *33*, 299–308. doi: 10.1901/jaba.2000.33-299

DeLeon, I. G., Iwata, B. A., & Roscoe, E. M. (1997). Displacement of leisure reinforcers by food during preference assessments. *Journal of Applied Behavior Analysis*, *30*, 475–484. doi: 10.1901/jaba.1997.30-475

Fisher, W. W., Lindauer, S. E., Alterson, C. J., & Thompson, R. H. (1998). Assessment and treatment of destructive behavior maintained by stereotypic object manipulation. *Journal of Applied Behavior Analysis*, *31*, 513–527. doi: 10.1901/jaba.1998.31-513

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, *25*, 491–498. doi: 10.1901/jaba.1992.25-491

Fisher, W., Piazza, C., Cataldo, M., Harrell, R., Jefferson, G., & Conner, R. (1993). Functional communication training with and without extinction and punishment. *Journal of Applied Behavior Analysis*, *26*, 23–36. doi: 10.1901/jaba.1993.26-23

Hagopian, L. P., Fisher, W. W., Sullivan, M. T., Acquisto, J., & LeBlanc, L. A. (1998). Effectiveness of functional communication training with and without extinction and punishment: A summary of 21 inpatient cases. *Journal of Applied Behavior Analysis*, *31*, 211–235. doi: 10.1901/jaba.1998.31-211

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*, 197–209. doi: 10.1901/jaba.1994. 27-197 (Reprinted from *Analysis and Intervention in Developmental Disabilities*, *2*, 3–20, 1982)

Iwata, B. A., Pace, G. M., Cowdery, G. E., & Miltenberger, R. G. (1994). What makes extinction work: An analysis of procedural form and function. *Journal of Applied Behavior Analysis*, *27*, 131–144. Doi: 10.1901/jaba.1994.27-131

Lalli, J. S., & Casey, S. D. (1996). Treatment of multiply controlled problem behavior. *Journal of Applied Behavior Analysis*, *29*, 391–395. doi: 10.1901/jaba.1996.29-391

Lalli, J. S., Casey, S., & Kates, K. (1995). Reducing escape behavior and increasing task completion with functional communication training, extinction, and response chaining. *Journal of Applied Behavior Analysis*, *28*, 261–268. doi: 10.1901/jaba.1995.28-261

Lalli, J. S., Vollmer, T. R., Progar, P. R., Wright, C., Borrero, J., Daniel, D., … May, W. (1999). Competition between positive and negative reinforcement in the treatment of escape behavior. *Journal of Applied Behavior Analysis*, *32*, 285–296. doi: 10.1901/jaba.1999.32-285

Lomas, J. E., Fisher, W. W., & Kelley, M. E. (2010). The effects of variable-time delivery of food items and praise on problem behavior reinforced by escape. *Journal of Applied Behavior Analysis*, *43*, 425–435. doi: 10.1901/jaba.2010.43-425

Mace, F. C. (1994). The significance and future of functional analysis methodologies. *Journal of Applied Behavior Analysis*, *27*, 385–392. doi: 10.1901/jaba.1994.27-385

McCord, B. E., Grosser, J. W., Iwata, B. A., & Powers, L. A. (2005). An analysis of response-blocking parameters in the prevention of pica. *Journal of Applied Behavior Analysis*, *38*, 391–394. doi: 10.1901/jaba.2005.92-04

Mevers, J. E. L., Fisher, W. W., Kelley, M. E., & Fredrick, L. D. (2014). The effects of variable-time versus contingent reinforcement delivery on problem behavior maintained by escape. *Journal of Applied Behavior Analysis*, *47*, 277–292. doi: 10.1002/jaba.110

Parrish, J. M., Cataldo, M. F., Kolko, D. J., Neef, N. A., & Egel, A. L. (1986). Experimental analysis of response covariation among compliant and inappropriate behaviors. *Journal of Applied Behavior Analysis*, *19*, 241–254. doi: 10.1901/jaba.1986.19-241

Patel, M. R., Piazza, C. C., Martinez, C. J., Volkert, V. M., & Santana, C. M. (2002). An evaluation of two differential reinforcement procedures with escape extinction to treat food refusal. *Journal of Applied Behavior Analysis*, *35*, 363–374. doi: 10.1901/jaba.2002.35-363

Payne, S. W., & Dozier, C. L. (2013). Positive reinforcement as treatment for problem behavior maintained by negative reinforcement. *Journal of Applied Behavior Analysis*, *46*, 699–703. doi: 10.1002/jaba.54

Pelios, L., Morren, J., Tesch, D., & Axelrod, S. (1999). The impact of functional analysis methodology on treatment choice for self-injurious and aggressive behavior. *Journal of Applied Behavior Analysis*, *32*, 185–195. doi: 10.1901/jaba.1999.32-185

Piazza, C. C., Fisher, W. W., Hanley, G. P., Remick, M. L., Contrucci, S. A., & Aitken, T. L. (1997). The use of positive and negative reinforcement in the treatment of escape-maintained destructive behavior. *Journal of Applied Behavior Analysis*, *30*, 279–298. doi: 10.1901/jaba.1997.30-279

Reid, D. H., Parson, M. B., Phillips, J. F., & Green, C. W. (1993). Reduction of self-injurious hand mouthing using response blocking. *Journal of Applied Behavior Analysis*, *26*, 139–140. doi: 10.1901/jaba.1993.26-139

Shirley, M. J., Iwata, B. A., Kahng, S. W., Mazaleski, J. L., & Lerman, D. C. (1997). Does functional communication training compete with ongoing contingencies of reinforcement? An analysis during response acquisition and maintenance. *Journal of Applied Behavior Analysis*, *30*, 93–104. doi: 10.1901/jaba.1997.30-93

Vollmer, T. R., Marcus, B. A., & Ringdahl, J. E. (1995). Noncontingent escape as treatment for self-injurious behavior maintained by negative reinforcement. *Journal of Applied Behavior Analysis*, *28*, 15–26. doi: 10.1901/jaba.1995.28-15

Received August 12, 2014
Final acceptance December 23, 2014
Action Editor, Michael Kelley
Guest Editor, Dorothea Lerman