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The Role of Context in the Evaluation of Reinforcer Efficacy: Implications for the Preference Assessment Outcomes

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Abstract

Highly preferred stimuli were identified via two preference assessments (based on Fisher et al., 1992), the second of which included stimuli that were ranked low in the initial preference assessment. Following the preference assessments, a subset of stimuli was evaluated as reinforcers in single- and concurrent-operant arrangements. In general, stimuli that were identified as highly preferred in the initial preference assessment functioned as more effective reinforcers. These results are discussed in terms of how the context in which stimuli are evaluated may play a role in the identification of effective positive reinforcers for individuals with autism and related developmental disabilities.

DESCRIPTORS

concurrent-operant; preference assessment; reinforcer assessment; single-operant

Positive reinforcement is one of the core principles of operant conditioning. Within the education and skill development of individuals with autism and related developmental disabilities, positive reinforcement contingencies are commonly employed. For example, Horner and Keilitz (1975) increased hygiene skills (e.g., tooth brushing) by providing social reinforcement and tokens to 8 adults with mental retardation. Positive reinforcement contingencies are also useful at decreasing problem behavior displayed by individuals with developmental disabilities. Repp, Barton, and Brulle (1983), for example, demonstrated decreased rates of problematic classroom behavior by using a differential reinforcement program in which participants were presented with access to preferred edibles contingent upon the omission of problem behavior.

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When developing a positive reinforcement-based program for individuals with autism and related developmental disabilities, it is important to note that the effectiveness of such programs may depend on multiple factors, including idiosyncratic preferences for different stimuli (Wehman, 1976). Simply put, different individuals display preferences for different stimuli (e.g., foods, objects, activities). Thus, stimuli that function as reinforcers for one individual may not function as a reinforcer for another individual.

The notion of individual preferences has produced an array of studies seeking to determine effective measures for identifying preferences for potential positive reinforcers (Hagopian, Long, & Rush, 2004). Because many individuals with autism and related developmental disabilities may lack the skills necessary to self-report their preferences, a large body of research has been devoted to the evaluation of direct observation-based methods of preference assessment. Though existing preference assessment methods vary, they possess common features. These include: (1) direct observation of a client's interaction with an array of stimuli, (2) data collection on that interaction, (3) a comparison of relative interaction with the stimuli under observation. Existing preference assessments differ in the manner in which stimuli are presented (e.g., singly or in pairs; Fisher et al., 1992; Pace, Ivancic, Edwards, Iwata, & Page, 1985), the manner in which data are collection (e.g., duration recording or trial-by-trial choices; DeLeon & Iwata, 1996; Roane, Vollmer, Ringdahl, & Marcus, 1998), and the range of stimuli identified as differentially preferred (Hanley, Iwata, Lindberg, & Conners, 2003).

The results of preference assessments usually present a relative hierarchy of stimulus preferences. That is, stimuli interacted with more often than others are generally deemed to be "highly preferred" (e.g., ranked among the top three stimuli interacted with) whereas those interacted with less often are considered "less preferred" (e.g., ranked among the lower half of stimuli engaged with). Generally speaking, research has shown that highly preferred stimuli function as more effective positive reinforcers than less preferred reinforcers. For example, Fisher et al. (1992) compared the relative reinforcing effects of stimuli selected on a high number of presentations to those stimuli selected on a relatively low number of presentations. Across all participants, the stimuli selected more often were associated with increased levels of responding (i.e., in-square behavior) relative to stimuli that were selected less often. Likewise, Glover, Roane, Kadey, and Grow (2008) used a combination of progressive-ratio (PR) and fixed-ratio (FR) schedules of reinforcement to compare responding for stimuli that were selected frequently (highly preferred) or infrequently (less preferred) during a preference assessment. The results showed that all participants engaged in more responding (e.g., completing math worksheets) to access the highly preferred stimuli rather than the less preferred stimuli under both PR and FR schedules. Moreover, these patterns of differential responding persisted even when the FR schedules were quite disparate (e.g., FR 23 for the high preference stimulus vs. FR 2 for the low preference stimulus). Similar results have been shown across other investigations (e.g., DeLeon & Iwata, 1996; Paclawskyj & Vollmer, 1995; Roane et al., 1998), suggesting that stimuli selected more often in preference assessments are generally more effective positive reinforcers.

Although it is commonly held that highly preferred stimuli are more effective positive reinforcers than less preferred stimuli, several investigations have suggested that stimuli that are lower ranked in a preference assessment also might function as effective positive reinforcers. For example, Roscoe, Iwata, and Kahng (1999) conducted a preference assessment based on the procedures described by Fisher et al. (1992). The preference assessment differentially identified stimuli as highly preferred or less preferred. Roscoe et al. went on to evaluate these two categories of stimuli as positive reinforcers by presenting high-and low-preference stimuli in a concurrent-operants arrangement (i.e., participants

could work to access either the high or the low preference stimulus). Subsequently, the less-preferred stimuli were evaluated as reinforcers using a single-operant arrangement in which responding produced access to only the low-preferred stimulus (i.e., the high-preference stimulus was not available in this condition). Under the concurrent-operants arrangements, the majority of participants (88%) showed a consistent preference for the high preference stimulus. However, when the low preference stimulus was evaluated alone, the majority of participants (86%) displayed increased rates of responding relative to a no reinforcement baseline condition. Roscoe et al. concluded that the manner in which stimuli are evaluated might impact whether those stimuli are found to be effective reinforcers. That is, a concurrent-operants arrangement may reveal a *relative* reinforcement effect by demonstrating that more responding is associated with one reinforcer relative to the other. By contrast, the single delivery of a stimulus may reveal *absolute* reinforcement effects by demonstrating that an individual will respond to a stimulus when it is the only available reinforcer. The results of the Roscoe et al. investigation suggest that low preference stimuli may be equally effective reinforcers under some circumstances, and that the simultaneous availability of high preference stimuli in a preference assessment might “mask” the identification of other potential reinforcers.

In a somewhat similar investigation, Taravella, Lerman, Contrucci, and Roane (2000) evaluated reinforcer preference and the relative reinforcing effectiveness of stimuli identified in preference assessments. All participants were exposed to two preference assessments (as described by Fisher et al., 1992). The first assessment consisted of 10 stimuli, whereas the 5 lowest ranked stimuli from the first (10 stimulus) preference assessment were included in the second preference. When the 5, less preferred stimuli were evaluated in the second preference assessment, results showed that one stimulus was selected on a high percentage of trials. In the subsequent reinforcer assessment, the stimulus from the second assessment maintained responding (e.g., placing a block in a bucket) at levels similar to responding associated with the stimulus from the initial (10 stimulus) preference assessment, suggesting that the stimuli initially identified as low preference would function as effective positive reinforcers.

Taken together, the combined results of Roscoe et al. (1999), Taravella et al. (2000) and other investigations (e.g., DeLeon, Iwata, & Roscoe, 1997; Francisco, Borrero, & Sy, 2008) suggest that the availability of relatively highly preferred stimuli (e.g., food) in a preference assessment might affect the identification of other potential reinforcers (i.e., those identified as less preferred). Correspondingly, preference assessments might result in an over identification of “false negatives” (i.e., stimuli that are identified as less preferred yet would function as effective reinforcers). Such outcomes may, in turn, lead some to question the necessity of conducting a preference assessment for individuals with autism and related developmental disabilities (e.g., both high and low preference stimuli might be effective reinforcers, so relative differences in stimulus rankings may be of secondary importance when developing positive reinforcement programs).

The aforementioned studies implicate the role of context in the identification of positive reinforcers. To reiterate, in those investigations, relatively highly preferred stimuli (e.g., a favorite food) impacted the identification of other stimuli as preferred. However, those less preferred stimuli functioned as effective reinforcers in a specific context (e.g., a single-operant arrangement in which responding was reinforced on an FR-1 schedule; Roscoe et al., 1999). It is important to note, however, that the role of less preferred stimuli as effective reinforcers is limited to the context in which those stimuli were evaluated as reinforcers (notwithstanding additional evaluation of those stimuli in other contexts). An erroneous assumption is to infer that a stimulus which functions as a reinforcer in one context will function as a reinforcer across other context (a condition referred to as “transituationality”;

see Timberlake & Farmer-Dougan, 1991 for additional commentary). Said another way, though a stimulus might function as a reinforcer in one context, it is not necessarily the case that the same stimulus will function as a reinforcer in a different context. Such results may have implications when developing habilitative or treatment programs for individuals with autism and related developmental disabilities.

The current investigation was designed to replicate and extend the results reported by Taravella et al. (2000) and Roscoe et al. (1999). Specifically, one research question was to determine if stimuli identified as less preferred in a preference assessment would function as effective positive reinforcers in a single-operant format (i.e., an arrangement in which only one stimulus is evaluated as a reinforcer) similar to the results obtained by Taravella et al. and Roscoe et al. It was hypothesized that both highly preferred and less preferred stimuli would function as similarly effective reinforcers in the single-operant context (i.e., when there was no alternative stimulus present). Secondly, the current research was designed to investigate the extent to which stimuli identified as less preferred in a preference assessment functioned as effective reinforcers relative to those stimuli identified as highly preferred when the participant was given a choice of which stimulus to respond for (i.e., a concurrent-operants arrangement). It was hypothesized that highly preferred stimuli would be more effective reinforcers than less preferred stimuli when both were compared in the concurrent-operants context.

Method

Participants, Settings, and Materials

Art was a 6-year-old boy diagnosed with autism, Jade was a 12-year old girl diagnosed with autism and visual impairments, and Ned was a 13-year-old boy diagnosed with autism, visual impairments, and a seizure disorder. All participants had been independently diagnosed with autism by a child psychiatrist (Art) or a developmental pediatrician (Jade and Ned) prior to the inception of this investigation. The diagnostic procedures varied across participants but included a review of various records (e.g., developmental profiles, education history), direct observation, and diagnostic interviews (e.g., Autism Diagnostic Interview-Revised; Lord, Rutter, & Le Couteur, 1994). All participants were ambulatory, all spoke in short sentences that consisted of 3 to 5 words. Art and Ned attended a partially mainstreamed classroom in their local districts, whereas Jade was educated in a multi-district self-contained classroom for individuals with developmental disabilities and problematic behavior.

Enrollment in the current investigation was based the participant's admission to an outpatient clinic that specialized in the treatment of problematic behavior. The primary referral problem was self-injurious behavior (i.e., hand biting) for Art, physical aggression (i.e., hitting and biting others) and property destruction (i.e., throwing and breaking objects) for Jade, and stereotypic behavior (i.e., hand mouthing and body rocking) for Ned. It should be noted that individualized treatments for each participant were developed prior to and separate from their inclusion in the current investigation. The current investigation was conducted within the context of their admissions, as reinforcer identification was a secondary goal for each child.

All sessions were conducted in self-contained rooms measuring approximately 3 m × 3.6 m. The rooms were padded along the walls, doors, and floors. The rooms contained various stimuli that were evaluated in the preference and reinforcer assessments (described below). A one-way observation window overlooked the room, and the room was equipped with audio and video recording equipment. Observers were seated behind the observation window and used pencil-and-paper data to record stimulus selections during the preference

assessments or laptop computers to record the duration of in-area behavior during the reinforcer assessments (computer data were collected using a specialized data collection program developed specifically for such observations).

Response Measurement and Interobserver Agreement

During the preference assessments, stimulus selections were defined as the participant extending an arm toward and touching one (or both) of the stimuli placed in front of him/her. Stimulus selection data were analyzed by the observers writing which stimulus was selected in a given trial and dividing the number of times each stimulus was selected by the number of times it was presented, multiplying the quotient by 100, to yield the percent of trials in which each stimulus was selected.

During the reinforcer assessment, in-area behavior was defined as a participant having more than half of his/her body in one portion of the room relative to another portion of the room (described below). Duration data were collected on the occurrence of in-area behavior and were analyzed by dividing the number of seconds in which the response was observed by the total duration of the observation (600 s), multiplied by 100. This product yielded the percentage of the session in which in-area behavior was observed.

A second observer independently collected interobserver agreement (IOA) data during 100% of the preference assessments and during 30.6% of all reinforcer assessment sessions. For stimulus selections, IOA was calculated on a trial-by-trial basis by comparing agreement on which of the two presented stimuli was selected and dividing the number of trials with agreement on stimulus selections by the total number of trials, multiplied by 100. During the reinforcer assessment, IOA on in-area behavior was calculated by dividing the smaller total of seconds of in-area behavior (for each area) by the larger total of seconds of in-area behavior (for that area) and multiplying the quotient by 100. IOA for stimulus selection was 100% for all participants, and IOA for in-area behavior averaged 99.8% (range, 98.3% to 100%) for Art, 95.9% (range, 89.2% to 100%) for Jade, and 100% for Ned.

Procedure

Preference assessments—Eleven (Art and Ned) or 10 (Jade) nonfood stimuli were evaluated in each participant's preference assessment. Stimuli were chosen for inclusion in the preference assessments based on the results of a structured interview (Fisher, Piazza, Bowman, & Amari, 1996) that was conducted with their caregivers prior to the initiation of the investigation. Stimuli included a variety of toys (e.g., cars), sources of tactile stimulation (e.g., vibrating toys), sources of auditory stimulation (e.g., radio), and sources of visual stimulation (e.g., videos).

Following the caregiver survey, two separate preference assessments (as described by Fisher et al., 1992) were conducted for each participant. The same methods were employed for both preference assessments; however, the number of stimuli included differed across assessments. The duration of the preference assessments varied based on the number of stimuli included and participant responding. However, there was a minimum one-hour break between the two preference assessments to control for satiation. During both preference assessments, all of the stimuli were presented in pairs, and each stimulus was paired with every other stimulus. The pair of stimuli was presented approximately 10 cm in front of the participant, and the stimuli were approximately 20 cm apart. The side upon which an individual stimulus was presented was counterbalanced across trials. When a pair of stimuli was presented, participants were given 5 s to emit a stimulus selection response (defined above). When a stimulus was selected, participants were given approximately 5 s of access to the stimulus they chose, that stimulus was recorded as "selected," and the other stimulus

was recorded as “not selected.” If the participant did not make a selection, the stimuli were briefly taken away, and re-presented after 5 s. If the participant did not make a selection on the second presentation, both stimuli were recorded as “not selected,” and a new pair of stimuli was presented. Attempts to approach both stimuli were blocked, and the stimuli were re-presented after a 5-s delay. Once all stimulus comparisons were made, the stimuli were ranked based on the number of times each stimulus was selected relative to the number of times it was presented. For example, if a puzzle was selected on 8 out of 10 presentations (80%) and a stuffed animal was selected on 2 of 10 presentations (20%), the puzzle would be identified as the highly preferred stimulus, and the stuffed animal would be identified as the less preferred stimulus. In the event that multiple stimuli were selected on the same number of presentations, the exact comparisons of those two stimuli was examined to determine which stimulus was selected when the pair was presented (though this procedure was modified for Ned, described below).

As noted before, two preference assessments were conducted for each participant, in a manner similar to that described by Taravella et al. (2000). However, the same procedures were employed for both preference assessments, and the two preference assessments differed only in terms of the number of stimuli that were evaluated. The initial preference assessment included all stimuli (11 stimuli for Art and Ned; 10 stimuli for Jade) and was deemed the full-array (FA) assessment. The highest ranked stimulus from this assessment (i.e., the stimulus selected on the most presentations) was referred to as the full-array (FA) stimulus in the subsequent reinforcer assessments. The second preference assessment consisted of the 5 (Ned and Jade) or 6 (Art) stimuli that ranked among the bottom half of the initial FA preference assessment outcome. This second assessment was referred to as the partial-array (PA) assessment, and the stimulus that was selected on the highest number of presentations in the PA assessment was referred to as the PA stimulus in the reinforcer assessments.

Reinforcer assessments—Prior to the reinforcer assessments, the session room was divided into three or four sections by marking off the floor using masking tape (Fisher et al., 1992; Roane et al., 1998). Across both phases of the reinforcer assessment, the room was divided such that there was one area measuring approximately 0.9 m × 3.6 m, in which the participant stood prior to the start of each session (i.e., the starting point). During the initial phase of the reinforcer assessment (FA stimulus vs. control [ctrl] or PA stimulus vs. ctrl), the remaining area of the room was divided into two halves, each measuring approximately 2.1 m × 1.8 m. The top panel of Figure 1 depicts the layout of the session room when divided for the first reinforcer assessment. During the second phase of the reinforcer assessment (FA stimulus vs. PA stimulus vs. ctrl), the remaining area of the room was divided into three sections, each measuring approximately 2.1 m × 1.2 m. The bottom panel of Figure 1 depicts the room layout for the second reinforcer assessment. One to 3, 10-min sessions were conducted daily. In an attempt to control for satiation, there was a minimum 5-min break between each reinforcer assessment.

All sessions began with the experimenter explaining the contingencies that would be in effect for the session. For example, the experimenter told the participant that he/she could go to the left side of the room and access the stimulus that was on that particular side (i.e., the FA or PA stimulus), or go to the right side and get nothing (i.e., the ctrl area; Fisher et al., 1992; Roane et al., 1998). After explaining the contingencies, the experimenter instructed the participant to “pick a side,” which cued the observer to initiate data collection. Once the participant picked a side, he/she received continuous access to the stimulus associated with that area (or nothing in the ctrl area) while the majority of his/her body was in that area. The participants were allowed to move from one area to another at any time, but could not carry a stimulus across areas (i.e., attempts to do so would have been blocked). Likewise, if

participants would have been deemed to be in both areas at once, the stimulus would have been removed from the participant until he/she moved more than half of his/her body into one area (this never occurred). Finally, no contingencies were arranged for remaining at the starting point (this never occurred).

After the first 5 min of each session, data collection on participant behavior was temporarily suspended [Note: this interval was not included in the data analysis]. During this interval, the experimenter removed any stimulus from the participant, repositioned the participant to the starting position and switched the stimuli from one side of the room to the other side (Roane et al., 1998). For example, if the right side of the room initially contained the FA stimulus and the left side was the ctrl area, the FA stimulus was switched to the left side of the room, and vice versa (the three areas were similarly repositioned in the second phase of the reinforcer assessment). After repositioning, the new contingencies were explained to the participant, and data collection resumed for another 5 min after the experimenter gave the instruction “pick a side.” The initial position of the stimuli was counterbalanced across all sessions in an attempt to control for position biases.

The first phase of the reinforcer assessment consisted of two comparison conditions. In the *FA stimulus versus control (FA vs. ctrl)* condition, the participants were given a choice between entering the area associated with the FA stimulus or the area associated with no differential consequences (i.e., the ctrl square). In the *PA stimulus versus control (PA vs. ctrl)* condition, the participants were given a choice between entering the area associated with the PA stimulus or the ctrl area. The FA vs. ctrl condition and the PA vs. ctrl conditions were compared in an alternating treatments design (Kazdin, 1982). This phase of the reinforcer assessment also was re-implemented in a reversal (ABA) design for Ned. The purpose of the FA vs. ctrl condition was to evaluate the reinforcing effects of the stimulus selected in the FA preference assessment, whereas the PA vs. ctrl condition evaluated the reinforcing effects of the stimulus selected in the PA preference assessment (Roscoe et al., 1999). That is, these conditions assessed the reinforcing effects of either the FA or PA stimuli in a context in which no other differentially preferred stimulus was concurrently available.

The second phase of the reinforcer assessment consisted of the *FA stimulus versus PA stimulus versus control (FA vs. PA vs. ctrl)*. During this phase of the reinforcer assessment, the session room was divided into 3 sections: one area contained the FA stimulus, another area contained the PA stimulus, and the third area was the ctrl area (i.e., no stimuli present). At the beginning of each FA vs. PA vs. ctrl session, the experimenter delivered the instructions for the contingencies associated with each area. After prompting the participant to select an area, the participant had continuous access to the stimulus associated with the respective area (or nothing in the control area). Five minutes after the beginning of each session, the respective contingencies were alternated, the instructions were re-presented, and the session continued in the manner described above. For example, if the left side of the room was originally the control area, the middle area contained the FA stimulus, and the right area contained the PA stimulus, the stimuli would rotate from left to right such that the middle area was now the control, the left area contained the PA stimulus, and the right area contained the FA stimulus. The initial position of the stimuli was counterbalanced across all sessions in an attempt to control for position biases.

The purpose of the FA vs. PA vs. ctrl condition was to determine whether providing an alternative stimulus (the FA stimulus) would alter the extent to which the PA stimulus functioned as a reinforcer. That is, we attempted to assess the relative reinforcing effects of the FA and PA stimuli in a context in which other alternatives were concurrently available. It was hypothesized that including access to the FA stimulus as an alternative would disrupt

the participant's response allocation toward the PA stimulus; thereby demonstrating that the reinforcing efficacy of the PA stimulus was context-specific (i.e., the PA stimulus would only function as a reinforcer when a more preferred alternative was not simultaneously available). A concurrent-schedule arrangement (Kazdin, 1982) was employed during the FA vs. PA vs. ctrl condition in which the relevant conditions (FA stimulus, PA stimulus, ctrl) were simultaneously available.

Results

Preference assessments

Results of the preference assessments are depicted in Figure 2. The left side of each panel shows the results of the FA assessment and the right side of each panel shows the results of the PA assessment. The FA stimulus identified for Art (top panel) was a video and the PA stimulus for Art was the markers (which were selected over the guitar during the presentation of these two stimuli in the PA assessment). For Jade (middle panel), the Leapster® was identified as the FA stimulus, and the arts and crafts activity was identified as the PA stimulus. Three stimuli resulted in the highest number of trials selected for Ned (bottom panel) during the FA assessment and these three stimuli were equally selected over one another in the FA assessment. Given this outcome, the ball was selected as the FA stimulus based on the observation that Ned appeared to interact with it more than the other stimuli selected on an equal number of trials. The rattle toy was identified as the PA stimulus for Ned.

Reinforcer assessments

The results of Art's reinforcer assessments are depicted in the top panel of Figure 3. During the FA vs. ctrl condition (left side of top panel), Art responded exclusively toward the area associated with the FA stimulus ($M = 99.4\%$ of session in area; note that data on time spent at the starting point are not depicted for any participants). These results suggest that the FA stimulus functioned as a reinforcer for in-area behavior in this specific context. In contrast, during the PA vs. ctrl condition, Art allocated more in-area behavior toward the control area ($M = 71.2\%$) relative to the PA stimulus area ($M = 25.6\%$). The results of the PA vs. ctrl condition suggested that the PA stimulus did not function as a reinforcer for in-area behavior. This outcome was bolstered by the results of the FA vs. PA vs. ctrl condition (right side of top panel) in which Art exclusively responded toward the area associated with the FA stimulus ($M = 99.6\%$).

For Jade (middle panel of Figure 3), both the FA stimulus ($M = 95.2\%$) and the PA stimulus ($M = 94.9\%$) appeared to function as effective reinforcers for in-area behavior in a context in which no alternative stimulus was available (left side of middle panel). However, when the FA and PA stimuli were simultaneously available (in the FA vs. PA vs. ctrl condition; right side of middle panel), Jade exclusively allocated responding toward the area associated with the FA stimulus ($M = 94.6\%$). These results suggest that the FA stimulus was also a reinforcer in this context, whereas the PA stimulus was not.

The reinforcer assessment results for Ned are depicted in the bottom panel of Figure 3. During both the FA vs. ctrl and PA vs. ctrl conditions (left side of bottom panel), Ned displayed near-exclusive responding toward the areas associated with the FA or the PA stimuli ($M_s = 97.4\%$ and 96.4% for the FA and PA stimuli, respectively). As was the case with Jade, Ned's results suggest that both the FA and PA stimuli functioned as reinforcers in a context in which no alternative stimuli were available. Similarly, during the FA vs. PA vs. ctrl phase (middle of bottom panel), Ned also displayed more responding toward the area associated with the FA stimulus ($M = 89.0\%$) relative to the PA stimulus or the ctrl area (M_s

= 3.5% and 0.8%, respectively). These results suggest that the FA stimulus also functioned as a reinforcer in a context in which an alternative stimulus (the PA stimulus) was concurrently available, whereas the PA stimulus was not a reinforcer in this context. To replicate that the PA stimulus would function as a reinforcer in the absence of the FA stimulus, the FA vs. ctrl and PA vs. ctrl conditions were re-implemented and Ned again allocated more responding toward the areas associated with the stimuli ($M_s = 96.6\%$ and 95.3% for the FA and PA stimuli, respectively; depicted on the right side of the bottom panel).

Discussion

The use of positive reinforcement contingencies is common among habilitative and treatment programs for individuals with autism and related developmental disabilities; thus, identification of stimuli that will function as effective positive reinforcers is critical in the development of such programs. Over the past 25 years, a number of preference assessments have been developed in an attempt to accomplish this goal. Although it is commonly held that stimuli identified as highly preferred in a preference assessment will function as effective positive reinforcers (Fisher et al., 1992), a growing number of investigations (e.g., DeLeon et al., 1997; Francisco et al., 2008; Roscoe et al., 1999; Taravella et al., 2000) have demonstrated the less preferred stimuli also may function as positive reinforcers. Such outcomes may give the impression that a stimulus which functions as a reinforcer in one context will also function as a reinforcer in another context.

The purpose of the current investigation was twofold. First, we attempted to replicate the results of Roscoe et al. (1999) and Taravella et al. (2000) by demonstrating that less preferred stimuli would function as effective positive reinforcers under certain circumstances. This evaluation was conducted by comparing response allocation for either the FA or PA stimulus relative to a control condition. For 2 of the 3 participants, the PA stimulus functioned as a reinforcer in this context (the FA stimulus functioned as a reinforcer in this context for all participants). These outcomes partially replicated the results of Roscoe et al. and Taravella et al. in that stimuli that were initially identified as less preferred in a preference assessment functioned as effective reinforcers in a context in which no alternative stimuli were simultaneously available. In contrast to the results obtained from Jade and Ned, the PA stimulus (i.e., markers) did not function as an effective reinforcer for Art. These results suggest that the PA preference assessment for Art identified the PA stimulus as a false positive reinforcer for the target response. Unfortunately, it is unknown if other highly preferred stimuli from the PA preference assessment (e.g., the guitar) would have functioned as an effective reinforcer for Art or if the markers would have functioned as a reinforcer for some other target response.

The second reinforcer assessment was conducted to determine the impact of providing an alternative stimulus (the FA stimulus) on the reinforcing effects previously observed with the PA stimulus. Recall that the purpose of this assessment was to demonstrate the context-specific nature of reinforcement. Specifically, it was anticipated that providing concurrent access to the FA stimulus would alter the extent to which the participant's responded to access the PA stimulus. All three participants displayed more responding for the FA stimulus than the PA stimulus when the two were simultaneously available. These outcomes confirm the initial results of the FA preference assessment (i.e., that more responding would be allocated toward the FA than the PA stimulus) support the hypothesis that the reinforcing efficacy of the PA could be disrupted by modifying the context in which it was being evaluated as a reinforcer. These results also align with previous findings that, when a choice is presented among stimuli, response allocation is sensitive to the relative preference for those stimuli (Fisher & Mazur, 1997; Neef, Mace, Shea, & Shade, 1992).

For all participants, the initial preference assessment identified a stimulus that was highly preferred (i.e., the FA stimulus). The second preference assessment identified a stimulus that was relatively preferred to the other, initially low preference stimuli in the array (i.e., the PA stimulus), and in all cases the selection percentages for the highest stimulus in the PA assessment (80%, 100%, and 75% for Art, Jade, and Ned, respectively) were similar to the selection percentages of the highest stimulus in the FA assessment (100%, 100%, and 80% for Art, Jade, and Ned, respectively). The results of the FA and PA preference assessments replicated the results of Taravella et al. (2000) in that when low preference stimuli were assessed among themselves (in the PA preference assessment), one (or two) stimulus emerged as highly preferred relative to the others.

A potential conclusion of the current results is that less preferred stimuli might function as effective positive reinforcers and that the inclusion of additional highly preferred stimuli in a preference assessment array might interfere with the identification of other potentially effective positive reinforcers (DeLeon et al., 1997; Taravella et al., 2000). Although this may be the case, the results of the second reinforcer assessment (FA vs. PA vs. ctrl) suggested that, when the FA and PA stimuli were evaluated as reinforcers in a concurrent arrangement, more responding was allocated toward the FA stimuli. Thus, the current results suggest that although initial low-ranked stimuli may function as effective reinforcers, these stimuli are less effective reinforcers than those initially identified as highly preferred when paired in a choice context; a finding that is predicated upon earlier research (e.g., Fisher et al., 1992; Roane et al., 1998). A potential implication of this finding may be that less preferred stimuli might function as effective reinforcers for some responses, but may be ineffective when alternative and relatively more preferred sources of reinforcement are concurrently available.

The current results may be limited by several factors. First, the reinforcer assessments were conducted in the same order for all participants. It is possible that the initial phase of reinforcer assessments could have created a relative history of responding for the PA stimuli which might have affected responding in the subsequent experimental arrangement (Roscoe et al., 1999). However, any such history of reinforcement with the PA stimuli did not appear to affect the results of the FA vs. PA vs. ctrl assessments, as responding for these stimuli did not persist.

A second limitation is that the current investigation employed relatively simple target responses (i.e., in-area behavior) to demonstrate a reinforcement effect for the FA and PA stimuli. The use of such responses may limit the generality of the obtained results. That is, the data obtained in the current investigation may have limited application to situations in which stimuli are used as reinforcers for more complex responses (e.g., completing school work). However, the use of simple responses has been used repeatedly in other reinforcer assessment investigations (e.g., Fisher et al., 1992; Roane et al. 1998). Moreover, the use of a simple operant response may be beneficial (as opposed to a more complex response) because simple response do not require extensive training in order to evaluate the reinforcing effects of a stimulus (Piazza, Fisher, Hanley, Hilker, & Derby, 1996). Nevertheless, further research should consider evaluating the differential effectiveness of FA and PA stimuli as reinforcers using more complex target responses.

It is also arguable that the target responses between the preference assessments (i.e., reaching for a stimulus) and the reinforcer assessments (i.e., being in an area of the room) were not significantly different. This is particularly relevant given the stimulus selections participants made during the preference assessments. All three participants selected the eventual FA stimulus over the eventual PA stimulus when the relevant comparisons were presented in the initial FA preference assessment. Toward that end, one could conclude that

the results of the reinforcer assessments may contribute only slightly beyond the data derived from the preference assessments. Though both of these responses are relatively simple topographically, the reinforcer assessment afforded a more comprehensive evaluation of relative reinforcer effects (during the FA vs. ctrl and PA vs. ctrl phases) and choice responding (during the FA vs. PA vs. ctrl phases).

The current study has relevance to the assessment of positive reinforcers for individuals with autism and related developmental disabilities. As noted above, one erroneous conclusion that could be drawn from previous investigations is the less preferred stimuli might be as effective reinforcers as their highly preferred counterparts. The current results suggest otherwise; that is, it is the context in which the stimuli are evaluated, rather than specific properties of the reinforcers themselves, that permits one to draw conclusions about the efficacy of those stimuli as reinforcers (Timberlake & Famer Dougan, 1991). Practically speaking, the use of stimuli that do not serve as effective reinforcers could impact the success of habilitative or treatment programs for individuals with autism and related developmental disabilities, which could impact their independent living skills, their social integration, and their quality of life. Such issues may incorrectly suggest that the lack of adaptive responding in such programs is due to a skill deficit (e.g., the individual does not possess the necessary pre-requisite skills) when it may be due to a performance deficit (e.g., the stimulus presented contingent upon responding does not operate as a reinforcer).

It should be noted that the context in which a stimulus is evaluated is only one variable that might effect how well that stimulus functions as a positive reinforcer. Other variables, such as response effort (Piazza, Roane, Keeney, Boney, & Abt, 2002), having supplemental access to reinforcement (Roane, Call, & Falcomata, 2005), and choice among various qualities of reinforcement (Neef et al., 1992) might impact reinforcer preference and response allocation. Future research should evaluate the role of such variables in the identification of reinforcers for individuals with autism and related developmental disabilities. Additional research should also examine and replicate these current results as well as the results of the Taravella et al. (2000) and Roscoe et al. (1999) investigations in the natural environment to determine if the extent to which less preferred stimulus function as reinforcers in non-clinical settings. Finally, future research might examine the extent to which less preferred stimuli function as reinforcers in the presence of concurrently available, highly preferred social reinforcers (e.g., peer attention).

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Figure 1.
The division of the session room during the FA vs. ctrl and PA vs. ctrl (top panel) and the FA vs. PA vs. ctrl (bottom panel) phases of the reinforcer assessment.

Figure 2. Results of the full-array and partial-array preference assessments for Art (top panel), Jade (middle panel), and Ned (bottom panel).

Figure 3. Results of the reinforcer assessments for Art (top panel), Jade (middle panel), and Ned (bottom panel).