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EVALUATION OF A PROGRESSIVE MODEL FOR IDENTIFYING
PREFERRED STIMULI FOR CHILDREN WITH
DEVELOPMENTAL DISABILITIES

by

Amanda M. Karsten

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TABLE OF CONTENTS

Table of Contents – Continued

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The quality of life for individuals with developmental disabilities is dramatically

impacted by mild to severe deficits in adaptive behaviors associated with self-care,

communication, social behavior, and motor development. The emergence of aberrant

behaviors may also present barriers to independence and, in some cases, physical risks.

Technologies from the field of applied behavior analysis have proven effective in

teaching skills and reducing problematic patterns of behavior with developmentally

disabled populations (Chambless & Ollendick, 2005; Reid, Phillips, & Green, 1991;

Sallows & Graupner, 2005). One defining attribute of the behavioral approach to

treatment is a heavy reliance upon the availability of reinforcing stimuli that can be

delivered contingent upon improved or alternative responding during intervention,

thereby increasing the occurrence of adaptive responses and replacing maladaptive

behaviors.

Effective reinforcers play a key role in teaching procedures such as chaining and

shaping and in the treatment of certain problem behaviors. Behavior chains consist of a

sequence of operants, each of which is evoked by the completion of the prior step and

reinforced by the opportunity to engage in the following step. Behavior chains typically

terminate with the delivery of a primary reinforcer (Catania, 1998). Establishing chains

is useful when targeting adaptive skills involving a reliable sequence of responses, the

completion of which corresponds to a naturally occurring opportunity for direct

reinforcement of the entire chain (e.g., eating after preparing a meal, going outside after getting dressed, receiving employer praise and compensation after completing an assigned task at work). The clinical procedure for producing behavior chains is referred to as chaining, and may take one of several forms. Steps within the chain can be taught simultaneously (total task presentation), from the first to the last step (forward chaining), or beginning with the final step and teaching in reverse order (backward chaining). Mastery is required at each point before proceeding to the next step. Potent programmed reinforcers are typically delivered contingent upon the completion of each new step until the entire sequence is mastered and naturally occurring antecedents and consequences effectively maintain the response chain. Behavioral chaining has been used to teach adults with developmental disabilities to independently do their laundry (McDonnell & McFarland, 1988) and execute skills relevant to paying bills (LaCampagne & Cipani, 1987), among other repertoires. Taylor, Levin, and Jasper (1999) also used a combination of forward chaining and video modeling interventions to increase the play-related comments of two children with autism during sibling interactions. Teacher praise and tangible rewards (e.g., edibles) were provided each time participants imitated scripted comments during training. These responses also generalized to play sessions with siblings for both children.

Shaping procedures, or the differential reinforcement of successively closer approximations to a target response (Catania, 1998) are applied when a variation of the behavior that is being taught exists in the repertoire of the learner at the time of intervention. Shaping can be applied in at least two ways: to alter an existing response along a specific dimension (e.g., to teach faster responding) or to teach a new response

(e.g., vocal requests). For example, where the former case is concerned, a child may independently dress himself for school, but not quickly enough to catch the bus. A shaping procedure could be used to teach the child to complete the same steps faster by setting gradually shorter time limits for dressing. Reinforcement of dressing behavior would then be contingent upon meeting the time-based goal at each opportunity. Dimensionally shaped targets from the literature include school attendance (Meyer, Hagopian, & Paclawskyi, 1999) and speech volume (Jackson & Wallace, 1974) with individuals with disabilities. When a new topography of response is the target, principles of shaping may be used to differentially reinforce successive approximations of the response. In the case of teaching language, an individual may emit a variety of vocal sounds but not under appropriate or specific stimulus control. A shaping procedure could be used to select existing vocal approximations of a particular request for a known reinforcer (e.g., "music"). After increasing the frequency of the initial response (e.g., "m" sound), subsequent occurrences are placed on extinction until a closer approximation (e.g., "mu" sound) to the terminal response is emitted. This process continues until the target behavior (the vocal request for "music") is established.

Many individuals with developmental disabilities exhibit patterns of aberrant behavior that can interfere with learning opportunities and, in some cases, present the risk of physical harm for the individual and others. These behaviors vary widely in form and severity. Topographies include self-injurious behavior (e.g., head banging, biting, skin picking), pica, aggressive behavior, stereotyped motor behavior (e.g., hand-flapping, body-rocking, toe-walking), and stereotyped vocal behavior (e.g., humming,

repetition of particular phonemes). The process of functional assessment and subsequent development of function-based interventions for the reduction of these behaviors has proven very effective (Kurtz et al., 2003; Newcomer & Lewis, 2004). However, treatment challenges arise when behavior is maintained by automatic reinforcement (i.e., consequences that cannot otherwise be manipulated due to ethical or safety concerns). Under these circumstances, clinicians must identify stimuli that are likely to attenuate or compete with reinforcers for ongoing problem behaviors.

Preference assessments have been used to identify which of several stimuli are associated with the lowest levels of problem behavior prior to intervention, and therefore, can be used in the context of treatment. While the specific procedures associated with competing stimulus assessments will be discussed in detail at a later point, one early illustration of this application of preference assessment methods to the treatment of problem behavior is provided here. Piazza and colleagues (1998) evaluated a modified preference assessment approach (single-stimulus engagement) for identifying competing stimuli for the treatment of automatically reinforced pica of three children diagnosed with developmental disabilities. Researchers utilized caregiver reports to gather 18 to 20 likely preferred stimuli that were also predicted to compete with pica based on the production of comparable sensory stimulation. Items were presented singly and the total duration of participant engagement with each stimulus was measured in addition to the occurrence of pica. Items that corresponded to the highest levels of engagement and the lowest levels of pica were then made continuously available during subsequent phases of treatment. Levels of problem behavior decreased

significantly with the availability of highly preferred, competing sources of stimulation in all three cases.

Because ready access to stimuli that function as reinforcers is a prerequisite for the effectiveness of many teaching and reductive interventions, methods for the identification of preferred stimuli are clinically essential. A variety of these methods have emerged in the literature over the last three decades. The earliest attempts to identify reinforcers were based upon verbal reports from individuals (Barrett, 1962) or caregiver interviews (Favell & Cannon, 1979). This typically involves the therapist asking a teacher or parent "What do you think he/she will work for?" Alternatively, items can be listed as the individual or caregiver reports the degree to which each item is preferred according to a Likert-type scale (e.g., rate each item 1 to 5) or designated verbal ratings (e.g., "a lot", "a little", "not at all"). Data collected to date suggest that the survey approach to identifying reinforcers fails to consistently produce accurate information when based on parent or teacher opinion (Green et al., 1988; Mason, McGee, Farmer-Dougan, & Risley, 1989) and the self-reports of children with ADHD (Northup, 2000; Northup, Jones, Broussard, & Vollmer, 1996). Reinforcer surveys have also been published for use with adults with developmental disabilities (Milestone Reinforcer Survey; Fox & DeShaw, 1993) and aging populations (Geriatric Reinforcer Survey; Houlihan, Rodriguez, Levine, & Kloecki, 1990). Similarly, the information generated by these surveys has yet to be verified via direct observation or reinforcer evaluation. Another early approach to preference assessment involved monitoring the frequency and duration of interaction between individuals and specific stimuli over several days when a wide variety of toys were available (Quilitch, Christopherson, &

Risley, 1977). This relatively informal and time-consuming approach was succeeded

by a number of methods that are characteristically data-driven, objective, and carry a

unique set of advantages and limitations, respectively.

Single-Stimulus Preference Assessment

Pace, Ivancic, Edwards, Iwata, and Page (1985) developed and evaluated a

single-stimulus (SS) preference assessment with six children and adolescents diagnosed

with profound mental retardation. In their first experiment, participants were repeatedly

presented with 16 stimuli, one at a time, and the frequency of approach responses (i.e.,

moving hand or body toward a stimulus) was recorded for each stimulus. Items were

selected for inclusion in the assessment based on accessibility at the time of assessment

and ease of delivery. Stimuli included a light box, a mirror, graham crackers, juice, hug

from a therapist, a fan, among others. Assessment sessions consisted of 20 trials, and

four stimuli were made available on five trials within each session. Sessions were

conducted until every stimulus had been presented on 10 occasions. Each trial

consisted of the therapist presenting a stimulus and allowing a 5 s opportunity for the

participant to approach that stimulus. If an approach response occurred, an additional 5

s of access was provided before a new item was presented. Because participants were

not necessarily exposed to all of the stimuli prior to assessment, failure to approach a

new stimulus was followed by a single prompt to approach, and a follow-up opportunity

to do so independently. Four participants reliably approached a variety of stimuli

(mirror, coffee can, dried flower, vibrator, fan, beep, heat pad, cool block) on the

majority of trials (i.e., 80% or more), whereas, two participants approached very few

stimuli (cracker, juice) on a consistent basis. A second experiment sought to evaluate

the predictive validity of findings from this SS preference assessment by manipulating the consequences for participant responses to simple instructions ("Reach", "Look", "Raise hand", "Touch hand") in a reversal design. Programmed consequences were withheld during one phase (baseline). The two remaining conditions entailed the contingent delivery of an item approached on at least 80% of assessment trials (high-preference) and the delivery of an item approached on no more than 50% of trials (low-preference). Though results were not particularly robust, performance consistently favored the high-preference reinforcement conditions across participants. However, it should be noted that the degree of differentiation between preferences detected by the SS method was inflated. In other words, the assessment method successfully identified a set of comparably potent reinforcers but was less effective for identifying a hierarchy of relative preferences (i.e., majority of stimuli approached; high- and low-preference stimuli maintained similar levels of operant behavior).

The limitations of the original SS preference assessment included the lengthy time that it took to implement (i.e., several days) and the probabilistic outcome that a hierarchy of relative preferences would be identified. In some cases, for example, individuals may approach stimuli because alternatives are unavailable. In other words, access to any stimulus may uniformly be preferred to the absence of stimuli. The probability of identifying false positives with traditional SS assessments is further enhanced by a general problem with any procedure attempting to evaluate preferences based on the occurrence of approach or selection responses. When all stimuli are equally likely to evoke approach responses by an individual, the SS method does not afford the opportunity for therapists to differentiate high-preference from moderate- and

low-preference items. Clinically, the availability of a variety of more and less potent reinforcers may be important in avoiding satiation, decreasing the probability of prompt dependence, and facilitating the generalization and maintenance of new behaviors. Hence, supplemental or modified technologies were later developed to more reliably produce such differentiated findings (e.g., Fisher et al., 1992).

One modification of the SS method of preference assessment specifically addresses the limitations of potential false-positives and failure to identify a hierarchy of relatively preferred stimuli by evaluating engagement over a longer period of access (DeLeon et al., 1999). Most recently, Hagopian, Rush, Lewin, and Long (2001) tested the validity of preferences identified via repeated SS engagement (SSE) assessments with two children and two adults diagnosed with autism and moderate to severe cognitive impairments. Participants were provided two min to engage with each of 8 to 13 edibles, toys, and activities identified as preferred by caregiver reports on the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996). The cumulative number of seconds spent engaging with or consuming each stimulus was recorded, and relative preferences were determined based upon scores gathered over three assessments completed within a one-week period. Stimuli identified as high-, medium-, and low-preference items during the SSE assessment were then evaluated for relative reinforcement effects using a concurrent-operant reinforcer evaluation (Piazza, Fisher, Hanley, Hilker, & Derby, 1996). During pre-evaluation training, the participant behaviors of standing in 1 of 3 available squares, sitting in 1 of 3 available chairs, or placing tokens in 1 of 3 available containers were reinforced using reportedly preferred items that were not included in the SSE

assessment. After participants reliably responded on 80% of training trials, the evaluation was initiated. Each session began with forced contact or a verbal description of the stimuli that were available in each area (e.g., no-stimulus control, medium-preference stimulus, high-preference stimulus). Participants then had the opportunity to select a square, chair, or container. Corresponding stimuli were available continuously as the participant engaged in the target response. Duration of time spent engaging in the target response was recorded for each available stimulus. Data demonstrated that the relative reinforcing effects of high-, medium-, and low-preferred stimuli matched predictions based on the SSE assessment results. This variation of the SS method may offer a useful alternative to earlier attempts to identify preferred stimuli for individuals with developmental disabilities, particularly when factors such as participant deficits in orienting to multiple stimuli (scanning), participant history of approaching any stimulus offered, or stimuli requiring lengthier intervals for engagement (i.e., activities) are present.

As it was previously discussed, SSE preference assessments are uniquely equipped to provide information on relative levels of interaction and problem behaviors. This renders them especially valuable in the capacity of identifying stimuli for use in the treatment of automatically reinforced problem behavior. Piazza, Adelinis, Hanley, Goh, and Delia (2000) assessed competing sources of alternative stimulation to reduce the frequency of three topographies of automatically reinforced problem behavior for two children and one adolescent diagnosed with severe to profound mental retardation. An SS preference assessment adapted from procedures described by Pace et al. (1985) was used to evaluate preference and associated levels of problem behavior for two

categories of stimuli. One category included items hypothesized to produce a matched type and quality of stimulation for the target behavior (e.g., shaving cream on a smooth surface to match stimulation associated with manipulation of saliva), while the second category of stimuli was unmatched (e.g., sound of radio unlikely to match stimulation associated with manipulation of saliva). Stimuli were presented singly for each 30 s trial, and the occurrence of problem behaviors and engagement with each stimulus were recorded. Stimuli that corresponded to the lowest levels of problem behavior and the highest levels of engagement were subsequently evaluated in the context of treatment evaluations comparing the effects of matched and unmatched stimuli on target behaviors. An ABAB reversal design was used with two participants, while a multielement design was employed for the third. Results from these evaluations suggested that the noncontingent delivery of matched stimuli associated with low problem behavior and high engagement during the SS preference assessment was more effective in reducing problem behavior than the delivery of those stimuli that were unmatched to the hypothesized stimulus functions of automatically reinforced target behaviors. It should also be noted that high-preference stimuli identified from the unmatched category did produce some level of reduction below baseline measures of problem behavior for all three participants. This suggests that stimulus selection based upon preference alone has some limited implications for the effective treatment of automatically reinforced problem behaviors.

Fisher, DeLeon, Rodriguez-Catter, and Keeney (2004) also evaluated a pre-treatment competing stimulus assessment for three children and one adult diagnosed with mild to severe mental retardation. All participants underwent functional analyses

for aggressive, self-injurious, or disruptive behaviors, and attention functions were identified for each participant. Following functional analysis, a competing stimulus assessment was conducted using a variety of stimuli identified via prior PS preference assessments and caregiver nomination. The competing stimulus assessment consisted of multiple trials during which a single stimulus or activity (e.g., paper and pen, drawing board, playdough, bead toy, headphones with music) was presented and the putative reinforcer for problem behavior (physical or verbal attention) was delivered after every occurrence of those behaviors. By keeping the maintaining contingency for problem behavior intact during the evaluation, investigators were able to conservatively assess the likelihood that access to alternative stimuli or activities would compete with reinforcers for problem behavior. Two participants also experienced a noncontingent attention (verbal) condition, and one participant experienced a noncontingent attention (physical) condition during which the specified social consequences were delivered continuously throughout the trial period. Data were collected on the frequency of aggressive, self-injurious, and disruptive behaviors and the percentage of time spent interacting with the available stimulus or activity per trial. Trials ranged in length from 30 s to 4 min across participants. Each stimulus or condition was presented for a total of three trials during the competing stimulus assessment. Two to three stimuli or conditions associated with the lowest levels of problem behavior and the highest levels of engagement during the competing stimulus assessments were used in the final treatment evaluation phase of the experiment. Levels of problem behavior were recorded across baseline, NCA (continuous noncontingent attention) with extinction, NCT (continuous noncontingent access to tangibles) with extinction, and extinction-

alone conditions. All three treatment conditions produced a reduction in problem behaviors, but the NCT and NCA interventions resulted in the most effective and consistent decreases. In sum, these findings demonstrate that NCT is a viable alternative to NCA when caregivers or teachers are unable to provide attention without disrupting ongoing activities (e.g., providing group instruction, having a phone conversation). In addition, investigators found that both NCA and NCT enhanced the effects of extinction alone. Finally, results support the use of the modified SSE assessment method to identify stimuli associated with high levels of engagement and low levels of problem behavior to inform treatment efforts and the selection of items for use in the context of noncontingent reinforcement.

In sum, SS methods of preference assessment are quite conducive to identification of a small number of effective reinforcers or competing stimuli for individuals with developmental disabilities when resources of time and staff training opportunities (SSE only) are readily available. The primary limitations of the SS method include somewhat lengthy administration requirements, as described in the literature (multiple presentations of each stimulus over several days), relatively low probability of identifying a hierarchy of relative preferences, and relatively high probability of identifying false positives. When more sophisticated data collection systems are available (duration rather than occurrence / non-occurrence measures), concerns with respect to identification of relative preferences and false-positives may be ratified by the SSE variation of the assessment method.

Paired-Stimulus Preference Assessment

The practical need to detect a gradient, or a differentiated pattern, of relative

preferences was first addressed by the developers of the paired-stimulus preference

assessment (Fisher et al., 1992; Mason et al., 1989). The paired-stimulus (PS) method

involves presenting two stimuli across a series of assessment trials. Initially, this

procedure was implemented by Mason et al. as a brief, daily supplement to confirm that

the reinforcers identified via extended SS methods were still preferred days and weeks

thereafter. The first systematic PS approach to preference assessment was evaluated by

Fisher et al. (1992) with four children diagnosed with moderate to severe mental

retardation. Sixteen stimuli from the standardized list utilized in previous preference

assessment investigations were assessed with both the SS (Pace et al., 1985) and PS

methods. For the PS procedure, stimulus type and placement (i.e., right or left side)

were randomized across trials such that all items were paired against all other items

from the pool and to control for side biases that may result in the identification of a

false-positive preference. Participants were provided 5 s to select a stimulus and, if no

approach response occurred, the participant was prompted to briefly contact each

available stimulus. This prompted exposure was immediately followed by a second

opportunity to make an independent selection. The PS assessment identified nine

highly preferred stimuli (i.e., approached on at least 80% of trials), which were also

identified as highly preferred with the SS preparation. Of particular interest was the

fact that an additional 19 stimuli were identified as highly preferred by the SS method.

A subsequent reinforcer evaluation utilized a concurrent-operant procedure to test the

relative reinforcing effects of high-preference stimuli for which the assessment results

agreed (high-high) against those for which the assessment results disagreed (stimuli identified as highly preferred only by the SS method). Preferred stimuli were delivered in a conjugate manner when participants entered one of two available taped off squares on the floor or sat in 1 of 2 chairs. Two agreed upon high-preference stimuli and two disagreed upon high-preference stimuli were placed beside each square or chair. Participants spent significantly more time in the chairs / squares associated with agreed upon high-preference stimuli, suggesting that the PS method was superior in identifying potent reinforcers.

Subsequently, Piazza, Fisher, Hagopian, Bowman, and Toole (1996) used a concurrent-operant preparation similar to that described by Fisher et al. (1992) to determine whether the contingent delivery of high-, medium-, and low-preference items identified via PS preference assessments would predict high-, medium-, and low-measures of responding with three children and one adult with developmental disabilities. Caregiver interviews were conducted to identify a total of 12 to 16 preferred stimuli or activities for each participant. Paired-stimulus preference assessment procedures identical to those implemented by Fisher et al. were used to identify a hierarchy of preferred items. These stimuli were ranked according to the relative frequency with which they were selected. The three most reliably selected stimuli were considered high preference, the next three were identified as medium preference, and so on. Following the PS preference assessment, a concurrent-operant reinforcer evaluation was conducted in which an extinction/control option was always present with one of the following: high- vs. medium-preference stimuli, high- vs. low-preference stimuli, or medium- vs. low- stimuli. Sessions were 10 min in duration, and

stimuli were made available to participants inside squares and beside chairs. Overall, the findings of this investigation verified the relative reinforcement effects of a range of preferred stimuli identified via the PS assessment method.

Despite the differentiated outcomes and strong predictive validity of PS preference assessments, eliminating positional biases and lengthy administration time relative to other methods (DeLeon & Iwata, 1996) remain points of practical concern. First, positional biases can result in false-positive outcomes when participants reliably select stimuli based on placement on the right or on the left. Once identified, therapists may attempt to control for this bias by presenting stimuli farther apart or holding them vertically before the individual. If neither approach to controlling for positional biases is successful, an alternative assessment method may be required. Second, administration time is of practical concern insofar as more extensive and time consuming procedures are less likely to be integrated into daily routines of teachers and therapists. As mentioned previously, data suggest that preferences may change over time (Mason et al., 1989; Zhou, Iwata, Goff, & Shore, 2001). Investigators have started to identify a range of distal and proximal events that can affect shifts in preference (Gottschalk, Libby, & Graff, 2000; Hanley, Iwata, & Roscoe, 2006; McAdam et al., 2005). These findings support the notion that an important consideration in the development and selection of preference assessment methodologies is whether they can be implemented at least as frequently as preferences are subject to change. Multiple-stimulus preference assessments introduced one means of producing differentiated outcomes akin to PS assessment results but, prospectively, in less time.

Multiple-Stimulus Preference Assessments

Multiple-Stimulus Method

Windsor, Piché, and Locke (1994) were the first to evaluate a multiple-stimulus (MS) approach to reinforcer identification. Participants were eight adults diagnosed with severe to profound mental retardation. Six stimuli were concurrently available and participants had the opportunity to select one stimulus on each of 10 trials per session. A total of five sessions were completed with each participant. Results from the MS procedure were directly compared to results from a PS assessment of the same stimuli. While the MS method did substantially shorten administration time, the foreseeable problem of exclusive responding to a single stimulus reproduced one of the key limitations of earlier SS preference assessments. Because the most preferred item remained available after selection, it was rarely the case that participants shifted their responses to less preferred stimuli until satiation on the most preferred stimulus occurred. By the end of the investigation, a total of eight stimuli endorsed as preferred by caregiver report had never been selected by the participants. Additional session-by-session analyses from Windsor et al. revealed that the PS assessment also produced more reliable outcomes than the MS method, overall. Taken together, these data suggest that the MS method is best applied when the objective is to identify a single, highly potent reinforcer in little time.

The pattern of exclusive responding that often occurs with MS methods of preference assessment is contraindicated when clinical objectives require information about more than one likely reinforcer. For example, reinforcer variation is one remedy for satiation during instruction that requires at least two effective reinforcers (Bowman,

Piazza, Fisher, Hagopian, & Kogan, 1997; Dunlap & Koegel, 1980; Egel, 1980, 1981).

Further, some reinforcer thinning and differential reinforcement procedures for

acquisition and generalization involve the delivery of at least one relatively less

reinforcing and one more reinforcing consequences under certain conditions. In the

interest of effective teaching, methods of preference assessment that are both time

efficient and likely to yield information about a minimum hierarchy of relative

preferences are most valuable.

<u>Multiple Stimulus (Without Replacement) Method</u>

DeLeon and Iwata (1996) attenuated the risk of exclusive interaction with a

single stimulus and retained the benefits of brevity afforded by the MS preference

assessment with the introduction of the multiple-stimulus without replacement method

(MSWO). The original study examined relative efficacy and efficiency of the multiple

stimulus with replacement (MS), MSWO, and PS assessments in identifying preferred

stimuli. The degree of correlation between these assessment outcomes and the amount

of time required to administer each assessment were examined. Procedures for

implementing MSWO assessments included presenting 8 to 10 stimuli concurrently in

an array and providing participants with the opportunity to select one item per trial.

After a specific stimulus was selected, the placement of the remaining stimuli was

randomized and the selected item was removed from the array for subsequent choice

trials. This removal of stimuli marks the critical distinction between MSWO and the

earlier MS methodology. By removing a stimulus after it has been selected, the

therapist eliminates the possibility for exclusive responding. Thus, the MSWO is well

equipped to produce data reflecting fully differentiated, relative preferences. Each

assessment was repeated five times over the course of the DeLeon and Iwata study. The authors found a high correlation among the number and type of reinforcers identified as preferred by the MSWO and PS assessments. Additionally, measures of administration time across assessment types suggested that the time required to implement an MSWO preference assessment (mean, 21.8 min) was consistently half the duration required for a PS assessment (mean, 53.3 min). The conclusion of the study, therefore, was that the MSWO method is most likely to produce valid, comprehensive results in the shortest period of time.

Higbee, Carr, and Harrison (2000) extended the DeLeon and Iwata (1996) investigation by evaluating the predictive validity of a slightly modified MSWO preference assessment (three-array) with the aid of a more extensive, restricted-operant procedures implemented across the top four ranking stimuli for 9 adults diagnosed with developmental disabilities. During reinforcer evaluation, participants had the opportunity engage in free-operant button pressing for a series of 1-min sessions. The highest ranked stimuli from the MSWO assessment were delivered contingent upon button pressing behavior in separate conditions and the frequency of responding relative to baseline and across reinforcement conditions was examined in a multielement design with a reversal component. Orderly differentiation among reinforcement conditions was produced inconsistently, however, reinforcer evaluation results confirmed reinforcement effects of the first-ranked stimulus from preference assessments in 6 of 9 cases (highest ranks corresponding to highest response rates) and the second-ranked stimulus in one additional case. Results from this investigation extended previous research by demonstrating that three-array MSWO assessments reliably identify high-

19

preference stimuli that also function as reinforcers. The reduced-array modification to the MSWO method enhanced its utility as a quick approach to preference assessment.

Unlike SS and PS assessments, the efficacy of MS and MSWO assessment methods rely on at least one prerequisite skill. Sometimes referred to as scanning, this response entails visual orientation to all stimuli available in the lateral array prior to making a selection response. Providing brief exposure to all stimuli before assessment and prompting the scanning, or orienting, response prior to each selection trial may effectively reduce the risk of invalid results due to scanning failures. However, some individuals continue to make inconsistent or arbitrary selections when large arrays of stimuli are presented. In such cases, the PS method may still be a more effective, albeit lengthier, assessment option.

Free-Operant Method

Methods designed and evaluated to this point have many strengths and applications. Even so, the uniformly structured, trial-based characteristics of these techniques are difficult to implement with individuals who exhibit significant problem behavior. This may be particularly true in a classroom environment where other students are present and multiple activities must co-occur. Some individuals engage in aggressive, disruptive, or noncompliant behaviors when preferred activities are repeatedly interrupted (i.e., tangible-maintained problem behavior). Others may respond adversely to situations that share stimulus features with other instructional procedures (i.e., escape-maintained problem behavior). In these cases, free-operant (FO) preference assessments can generate useful information about reinforcers under

more naturalistic circumstances, thereby reducing the likelihood of problem behavior maintained by escape or tangible items.

Roane, Vollmer, Ringdahl, and Markus (1998) evaluated the use of a 5-min FO preference assessment with 10 individuals diagnosed with severe developmental disabilities. Sessions were conducted during which participants were allowed free access to a combination of foods, toys, and social consequences (e.g., praise, hugs) that were nominated as likely reinforcers by caregivers and staff. Items were made available around a table, and partial-interval recording was used to collect data on the percentage of intervals that each participant spent interacting with a specific stimulus or activity during the assessment. Six of 10 participants participated in 10-min validation sessions that followed the concurrent-operant evaluation procedures described by Fisher et al. (1992). Following brief training, participants had the option to enter 1 of 2 squares: a square associated with access to a high-preference stimulus or an empty square. The location of the control and high-preference stimulus squares was alternated halfway through the 10-min evaluation to control for side biases, and the participant was returned to the starting point and asked to make another selection. Each participant completed this brief reinforcer validation probe on one occasion. Five of the 6 participants spent the majority of their time in the squares corresponding to continuous access to a highly preferred stimulus. One participant did not enter either square during the evaluation. The remaining four participants from the study underwent reinforcer evaluations that included the delivery of more and less preferred items following instances of compliance with previously acquired tasks. Three participants spent the majority of their time at a workstation corresponding to the availability of preferred

stimuli, while one participant divided his time among two available works stations. Results from both evaluations confirm the predictive validity of the FO assessment for identifying effective reinforcers, at least where a single, high-preference stimulus is concerned.

A second experiment in the Roane et al. (1998) investigation involved the direct comparison of findings from FO and PS preference assessments. Eleven of 13 participants in the investigation exhibited higher levels of problem behavior during the PS assessment and the two methods identified the same most-preferred stimulus in approximately 50% of cases. The authors attributed the discrepancy between assessment findings, at least in part, to the high probability of shifts in preference over time. In general, the FO method was associated with less problem behavior, valid outcomes, and less administration time. As one might anticipate based on outcomes from other MS assessment methods, it should be noted that only the PS assessment produced a hierarchy of relative preferences for participants in this series of experiments. The FO method is a specific variation on restricted operant MSW assessments described previously, and thus, shares its limitation of exclusive responding with respect to a single, highly preferred stimulus.

Ortiz and Carr (2000) drew similar conclusions to those of Roane et al. (1998) in their comparison of the FO and MSWO assessments. Three children diagnosed with severe mental retardation completed MSWO and 5-min FO assessments. Both methods of preference assessment produced similar results regarding the top three preferred items, all of which were validated against low-preference items during the reinforcer evaluation. The FO method, while efficient and reliable, did identify fewer reinforcers

than the MSWO assessment. Here, again, the FO preference assessment shares the limitation of exclusive responding with the restricted-operant MSW assessment. This limitation precludes the emergence of a hierarchy of preferences, the value of which has been discussed with respect to acquisition-related clinical goals. One additional consideration is that FO assessments require continuous access to stimuli being evaluated. Extended exposure to reinforcers in the context of a preference assessment may affect the durability of those reinforcers during the teaching sessions that follow. In addition, the FO approach to assessing food preferences dictates that an individual is permitted free access to, presumably, high-preference foods for several minutes. Some caregivers may object to such procedures on these grounds. Finally, a practical limitation of this assessment method is that it requires a rather sophisticated data collection procedure (partial interval or duration recording) which may not always be available in clinical or educational settings.

Brief Preference Assessments

Changes in motivating operations may have a significant impact on those stimuli that function as effective reinforcers from one moment to the next. Fluctuations in preference were first documented by Mason et al. (1989). Single-stimulus preference assessments (Pace et al., 1985) were repeatedly administered with three children diagnosed with autism and responding and levels of problem behavior were monitored over the course of the study. In addition to observing dramatic decreases in problem behavior during assessment and instruction when highly preferred stimuli were available, the researchers observed that preferences for each participant changed from month to month.

Gottschalk, Libby, and Graff (2000) systematically evaluated changes in the preferences of four children diagnosed with developmental disabilities following periods of deprivation for a specific stimulus, free access to a single preferred item, and a control condition that allowed for equal access to all stimuli prior to the assessment, respectively. Four edibles were evaluated, per participant, under each of the aforementioned conditions. The resulting percentage of approach responses consistently increased following a 48-hour period of deprivation and decreased following 10 min of continuous access just prior to each preference assessment. Taken together, these findings suggest that preference assessments should be conducted on a regular basis to maximize the probability of identifying functional reinforcers over time. Time-efficient methods of preferences assessment are particularly conducive to such frequent use and the associated benefits.

While the MSW (Windsor et al., 1994), MSWO (DeLeon & Iwata, 1996), and FO (Roane et al., 1998) methods enable clinicians to administer preference assessments in less time than earlier approaches (e.g., Fisher et al., 1992), more recent studies have refined and validated methods for implementation on a daily, or more frequent, basis. One investigation evaluated the predictive validity of a reduced-array MSWO that required three, rather than five, presentations for each assessment (Carr, Nicolson, & Higbee, 2000). Three children diagnosed with autism underwent repeated MSWO preference assessments over a 1-month period. In contrast to the methods described by DeLeon and Iwata (1996), Carr and colleagues presented arrays of eight stimuli a total of three times per assessment. Results of these assessments were validated by a reinforcer evaluation that compared participant performance on previously acquired

targets presented in 15-trial blocks when high-, medium-, or low-preference stimuli were delivered contingent upon each correct response. Preference assessment results were confirmed for all participants, and while outcomes remained relatively stable over the course of the investigation, stimulus ranks varied somewhat between implementations.

DeLeon et al. (2001) conducted daily, reduced-array MSWO preference assessments and compared results with those obtained from a full PS assessment conducted at the beginning of the investigation. Daily preference assessments were completed using procedures similar to those described by DeLeon and Iwata (1996), though the assessment utilized in this study ended following the presentation of the complete stimulus array on just one occasion. If outcomes from these daily, brief assessments differed from those obtained during the original PS assessment, a reinforcer evaluation involving the delivery of the two discrepant, high-preference stimuli contingent upon academic or vocational responses was conducted. Five individuals diagnosed with developmental disabilities participated in the study. Steady preferences were observed for two participants, both of whom allocated the majority of their responses to one or two stimuli across assessments. The remaining three participants, all of whom were more likely to select a greater number of stimuli within a single assessment, demonstrated shifts in preference throughout the investigation. Discrepancies did occur on some occasions and the highest preference item identified by the more recent MSWO was reliably found to correspond to the higher levels of responding during reinforcer evaluation. These results extend previous findings by 1) reiterating the importance of frequent assessment to identify changes in the reinforcing

effectiveness of preferred stimuli and 2) verifying the relative reinforcing effects of differentially preferred stimuli in the context of an evaluation that used clinically representative (complex, effortful) responses.

In sum, reduced-array MSWO and FO assessments are among the most time-efficient methods for identifying stimuli that are likely to function as reinforcers with individuals diagnosed with developmental disabilities. While these preference assessment methods can save valuable time in research and clinical contexts, they also carry unique limitations. Specifically, MSWO assessments may not be effective for individuals who do not readily engage in scanning behavior prior to each trial or cannot be prompted to do so. This may result in arbitrary selection responses, positional bias, and the emergence of false-positive preferences if placement-randomization procedures are not carefully implemented. In addition, the MSWO method is among the structured, trial-based assessments that may evoke problem behavior. While the FO assessment is associated with lower levels of participant problem behavior, its primary limitation is that it may result in exclusive responding to a single, highly-preferred item. Though priority for identifying a hierarchy of relative preferences is more or less critical in light of different clinical and research objectives, it is generally cited as a disadvantage of this otherwise quick and valid method of preference assessment.

Practical Considerations

Little research has examined practical considerations that exist for staff and practitioners who are interested in implementing stimulus preference assessments but may not have an extensive background with the strengths and limitations of different methods. Preference assessments involve relatively complex procedures, including

those associated with implementation, data collection, and data analysis. For example, the PS assessment requires that the administrator tracks the order of stimulus presentations, pairings that have and have not been presented, and randomization of stimulus position across trials. While these tasks require minimal time and organization with the aid of much practice and well-designed data sheets, the unfamiliar staff person is likely to require specific training in order to implement the procedures effectively. Recent studies have evaluated the effects of staff training MSWO and PS assessments (Lavie & Sturmey, 2002; Roscoe, Fisher, Glover, & Volkert, 2007). Lavie et al. implemented a package that included instructional, video modeling, rehearsal, and feedback components to teach three staff members to conduct PS preference assessments. The total length of training was approximately 80 min per staff person and methods were effective in producing staff mastery of the assessment procedures as tested with three children diagnosed with autism. These results are promising in the respect that staff quickly acquired the skills needed to implement PS assessments, but some concerns remain as to whether supervisors in clinical and educational settings are likely to implement such intensive training procedures. Furthermore, it is unlikely that personnel who receive training in one or more specific methods are equipped to make relevant modifications or select among the alternatives in order to produce valid, useful outcomes.

Thus, one barrier to the frequent use of preference assessments in clinical settings relates to the shear number of methodological options and complexities associated with choosing among them. Collectively, data suggest that some preferences may not be verified (false positives) and potential reinforcers may be overlooked due to

temporary fluctuations in motivating operations (false negatives) (McAdam et al.,

2005). Some assessment efforts may fail to identify relative preferences when more

than one type or quality of reinforcer is needed. Each of the assessment methods

discussed throughout this manuscript (SS, PS, MS) corresponds to a unique subset of

potential barriers described here. Figure 1 provides a summary of those barriers which

should be considered when selecting the optimal approach to preference assessment for

a particular purpose and learner.

Given the number of pitfalls that can encumber preference assessment

methodology, practitioners may benefit from empirically supported guidance on method

selection and modification. Treatment manuals and published curricula for intensive

behavioral intervention with individuals diagnosed with developmental disabilities do

not presently summarize or address the pertinent issues. While contemporary resources

recommend the use of "individualized prompting and reinforcement" strategies and the

use of consequences with "differential value…some that are okay and some that are to

die for" (Leaf & McEachin, 1999, p. 27), little is said about how practitioners or parents

can identify these highly individualized, often transient stimuli. Recommendations

provided in similar texts include 1) soliciting a verbal report of things the learner likes

from caregivers, 2) observing the learner in a free-choice context (no further

specifications), and 3) obtaining information on specific assessment methods from a list

of references that includes many of those discussed in this manuscript (Maurice, Green,

& Foxx, 2001, p. 64; Noonan & McCormick, 2006, p. 176). The lack of systematic

integration of differentially applicable preference assessment methods into common

clinical resources, at present, may contribute to an unfortunate and costly circumstance

wherein this technology is not being consistently applied in educational and treatment settings. Efforts to organize the methodological options and prescribe remedies for common barriers are both feasible and necessary.

One avenue for resolving the issues that surround selection of preference assessment methods may derive from the literature on functional analysis. A progressive model (i.e., a decision-making algorithm) has been developed to guide the implementation of abbreviated to extended methods of functional analysis for every emerging circumstance with a large number of participants (Vollmer, Markus, Ringdahl, & Roane, 1995). Vollmer et al. conducted functional analyses using a sequence of assessment methods to identify controlling variables for the problem behaviors of 20 individuals with developmental disabilities. The least time-consuming, most general methods were implemented first, and more extended and specifically tailored analyses were completed contingent upon failure to produce clear outcomes within earlier phases of the model. Participants were exposed to the sequence of experimental procedures until a result sufficient to inform function-based treatment development was produced. Overall, functions were identified for 17 of the 20 participants with 30% of those requiring the most time-efficient assessment method to produce a useful outcome. Thus, the orderly progression of assessments proposed by Vollmer et al. was very effective for identifying behavioral functions for a large majority of participants. Furthermore, a clinician could follow this progressive model without being intimately familiar with the research literature on which it was based.

A similar progressive model may lend itself to the objective of organizing preference assessment methodologies according to time requirements and specific

clinical objectives. Simple solutions for barriers to valid preference assessment outcomes could also be integrated. For example, therapists interested in reducing rates of automatically reinforced pica may conduct a competing items assessment to identify safe alternative stimuli. At least two methods are appropriate to this task (i.e., FO, SSE). While it may be advisable to begin with the SSE approach due to an increased probability of identifying more than one item associated with low levels of problem behavior, the FO assessment may be considerably less time-consuming and yet result in equally useful and comprehensive information. In the case of teaching individuals with disabilities, reinforcer identification must be quick and informative with respect to multiple stimuli. The development of a progressive model for conducting and customizing these methods may be one avenue for increasing their use and, thereby, garnering the associated benefits for a larger proportion of consumers.

The purpose of the current investigation was to evaluate a progressive model for systematically advancing from one method of preference assessment to another until a minimum hierarchy of preferred stimuli was identified (i.e., two items). The model was developed with the objective of identifying at least two items for teaching purposes. It should be noted that other clinical functions (e.g., identification of stimuli that compete with problem behavior) of preferences assessments would be best achieved using an alternative model. The predictive validity of preference assessment outcomes were also tested using a concurrent-operant reinforcer evaluation (Fisher et al., 1992; Roane et al., 1998). The purpose of the reinforcer evaluation was to determine the relative reinforcing effects of high- and low-ranking stimuli. Results from these evaluations do not, however, provide information about the absolute reinforcing value[1] of the items.

METHOD

Participants and Setting

Participants were 17 children (age 4-11 years) diagnosed with a developmental disability as described in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994) and a corresponding educational classification. Please refer to Table 1 for a summary of participant information. While efforts were made to recruit children with a range of diagnoses and without a history of preference assessments (i.e., at least one formal or informal assessment per week for a one month period), all participants were diagnosed with an autism spectrum disorder. In addition, 9 of 17 children (53%) had prior experiences with one or more of the preference assessment methods evaluated in this study. Participants were recruited from schools for children with developmental disabilities, a Midwest clinic serving children with a wide range of educational and behavioral needs associated with their disabilities, and an early intervention program for children with autism in Canada. Children who had physical or sensory limitations substantial to restrict their ability to select and engage with materials at a table were excluded from the investigation.

Table 1

Participant Age, Diagnosis, and History with Stimulus Preference Assessments (SPA)

	Age	Diagnosis	History with SPA?
Matthew	4 yrs	Autism	Yes
Jacob	7 yrs	Autism	Yes
Ben	6 yrs	Autism	Yes
Jared	4 yrs	Autism	Yes
Brandon	5 yrs	Autism	Yes
Troy	6 yrs	Autism	Yes

Kevin	11 yrs	Autism	No
Josh	6 yrs	Autism	Yes
Austin	4 yrs	Autism	No
Andrew	6 yrs	PDD-NOS	No
Neil	7 yrs	Autism	No
Isaac	3 yrs	Autism	Yes
Jonah	5 yrs	Autism	No
Evan	7 yrs	Autism	No
Steve	7 yrs	Autism	No
Mark	9 yrs	Autism	No
Hannah	4 yrs	Autism	Yes

During participant screening, primary caregivers were asked to list preferred leisure items (e.g., headphones, coloring book, doll, puzzle) or activities (e.g., hugs, tickles) for their child. Only those children for whom at least four different stimuli were endorsed were eligible to participate in the study. Stimulus selection also favored those items for which caregivers and staff were able to restrict access outside of assessment sessions for the brief duration of the study, though this was not possible in every case.

All experimental sessions were conducted in a clear, quiet area of the participants' homes or schools that had been designated for the study. Participants attended no more than one session per day, 3 to 5 days per week. Preference assessment sessions lasted approximately 15 to 45 min, and sessions were terminated in the event that a participant attempted to leave the assessment area on three occasions after being prompted to return. Sessions were conducted with the experimenter seated beside or across from the participant at a table. During FO assessments and reinforcer evaluations, the experimenter remained in the assessment area, but did not interact directly with the participant unless to prevent elopement.

Pre-experimental Assessments

<u>Caregiver Nomination</u>

In order to identify a range of toys to include in stimulus preference assessments, one primary caregiver completed the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher et al., 1996) for each participant. The RAISD includes questions about the foods, toys, social consequences (e.g., praise, hugs), and sensations (e.g., water play, soft materials) that some individuals prefer. For the purpose of this investigation, the questions related to food preferences were not included in the interview. Caregivers were asked to list only those toys that their children could activate independently and that required no more surface area than a standard sheet of notebook paper (i.e., approximately 22 cm x 28 cm). The former recommendation was to ensure that the latency to the onset of potentially reinforcing attributes was uniform across stimuli and the latter was to ensure that 5 to 8 items would fit on the assessment table and be equally visible to the participant. Due to a restricted number of preferred toys for some participants, one larger item was included in the array on two occasions. In these cases, the presence of a wider range of toy sizes did not appear to affect participant selections. Also, social activities (e.g., listening to a story, playing catch, tickles) were included in preference assessments on three occasions. In each instance, the relevant stimulus was included in the array (e.g., book, ball) and the social component was delivered for 30 s immediately upon selection of the item. Parents of Jared and Hannah endorsed two interactions (i.e. tickling, scratching head, and singing) that were not associated with any materials. For these children, a familiar PECS icon representing each activity was included in the arrays. A brief

session prior to the preference assessment confirmed that the participant was able to make the relevant conditional (auditory-visual) discrimination on at least 4 out of 5 trials per icon. A minimum of four items or activities endorsed by the caregiver and one control were selected for use in the assessments that followed. The control stimulus for each participant was a safe toy that 1) was not endorsed as a preferred item by the caregiver and 2) was associated with minimal participant engagement during the sampling procedure. The purpose of the control toy, which was typically play food or a hand-held pinball game, was to ensure that at least one less-preferred stimulus was included for each participant. It should be noted that 5 of 17 participants (29%) did not have a control item included in their arrays due to experimenter error. The absence of the control toy was not a hindrance to clear and verifiable outcomes in any of these cases.

Stimulus Sampling Procedure

Prior to the first preference assessment, the participant had one 30-s opportunity to interact freely with each stimulus. This brief sampling opportunity had three functions. First, the procedure ensured that participants had exposure to each stimulus prior to the first selection trial. This was particularly relevant when items included in the assessment were endorsed by the parents but did not come directly from the child's home. Second, the procedure provided an opportunity for the experimenter to assess whether participants engaged in the inappropriate manipulation of any item. Inappropriate manipulation included throwing, banging, mouthing, or otherwise engaging with stimuli in a stereotyped or unsafe manner. If it was determined that items from the pool of preferred stimuli were too difficult to activate or too predictive

of inappropriate behavior during the sampling procedure, alternative stimuli were selected from the list of parent-nominated items. Finally, the sampling procedure confirmed that the control stimulus truly functioned as such (i.e., minimal participant engagement relative to other stimuli).

<div align="center">Data Collection</div>

<u>Preference Assessments</u>

Data were collected slightly differently for each assessment method (MSWO, PS, SSE, FO). In the case of MSWO assessments, observers recorded the order in which each stimulus was selected and whether that stimulus was manipulated appropriately. Appropriate engagement was scored any time the participant had physical contact with a stimulus while refraining from inappropriate manipulation of that item. The purpose of the criterion for appropriate engagement was to ensure that selected items would not be identified as preferred unless they were associated with some participant interaction. In addition to collecting data on the order in which stimuli were selected, the position from which they were selected and the occurrence of inappropriate manipulation or problem behavior was also scored for each trial. Following the presentation of three complete arrays, selection percentages were calculated for each stimulus by dividing the number of times each item was selected (0-3) by the number of times the item was available (sum of ranks) and multiplying by 100. Data for MSWO assessments were summarized in this way. While no participants were ultimately exposed to the PS assessment during this investigation, data collection would have consisted of recording the item selected from each pair that was presented. The assessment would continue until all stimuli were presented with all other stimuli on

one occasion. Selection percentages would then be calculated by dividing the total number of occasions a stimulus was selected by the total number of occasions that stimulus was presented and multiplying by 100%. Cumulative duration of engagement measures (seconds engaged per stimulus) were planned for both the SSE and FO preference assessments, though only the latter were utilized based on participant behavior. Hand-held stopwatches or laptop computers were used to collect these data. Two observers began timing when participants touched a stimulus and stopped timing when interaction ceased (i.e., item was put down) or the item was removed. In the event that more than one stimulus was manipulated simultaneously, the duration of engagement was recorded for each respective item. At the conclusion of the assessment, the cumulative duration of engagement (i.e., seconds spent in physical contact with each stimulus) was summed and compared to determine the presence of relative preferences (i.e., longer duration of engagement with some stimuli relative to others).

Reinforcer Evaluation

Observers measured the cumulative duration that a participant spent in each of three chairs corresponding to the high-ranking item, low-ranking item, and no item (i.e., control). Timing began when a participant sat in one of the three chairs (i.e., buttocks touching seat). Timing stopped at any point that the participant stood up from his or her current seat. If a participant returned to the chair after a period of absence, the duration of all additional visits was summed to reflect the cumulative duration of time spent with each item and graphed in terms of the proportion of the total time spent in each of three chairs.

Applying the Progressive Model

Following the completion of the pre-assessment RAISD and stimulus sampling procedure, the selection of preference assessment methods for each participant followed a detailed decision-making model, depicted in Figure 1. The complete progression included two iterations of an MSWO assessment, three iterations of a PS assessment, an SSE assessment, and an FO assessment. The first two methods prescribed by the model were selected with goals of time-efficiency (MSWO) and identification of a minimum hierarchy of preferred items (MSWO and PS) at the forefront. The two remaining methods were included to accommodate specific barriers to verifiable outcomes as they emerged during implementation of the first one to two methods.

PB?   **Multiple-Stimulus w/o Replacement A**
Horizontal Array
Multiple-Stimulus w/o Replacement B
Toy Box

Discrepant
S^R eval
results?

Revisit RAISD

Scanning problems?

PB?   **Paired-Stimulus A**
Paired Stimulus B
Wide Placement
Paired Stimulus C
Vertical Presentation

Discrepant
S^R eval
results?

Revisit RAISD

Positional bias?

PB?   **Single-Stimulus Engagement A**

Discrepant
S^R eval
results?

Revisit RAISD

Free-Operant Assessment A

Discrepant
S^R eval
results?

Revisit RAISD

*Figure 1.* *An illustration of the progressive model for selecting preference assessments.*

The MSWO method was attempted first with all participants and modifications

or alternative methods were implemented contingent upon identification of specific

barriers to success at this level. Production of a minimum hierarchy with any method

resulted in immediate entry to the reinforcer evaluation phase of the study. The

occurrence of prohibitive levels of problem behavior on three consecutive trials during any assessment resulted in the implementation of the FO assessment, during which problem behaviors would most likely be mitigated by eliminating the demand characteristics of the assessment period. Prohibitive levels of problem behavior were defined as any aggressive, self-injurious, disruptive, or noncompliant behaviors that presented a physical risk, precluded the implementation of assessment trials, or would be likely to disrupt ongoing classroom activities. Aggressive and self-injurious behaviors were never emitted by participants in this study. Specific examples of disruptive behaviors sufficient to advance to the FO assessment included negative vocalizations (e.g., screaming, crying) above conversational volume and inappropriate throwing of toys. Noncompliant behaviors were dropping to the ground and eloping from the assessment area. Again, problem behavior on three consecutive trials resulted in advancement to the FO assessment. The programmed decision to revisit the RAISD was planned when results from reinforcer evaluations were discrepant with assessment outcomes and the presence of other barriers was ruled out. In terms of session termination criteria, participants who left the assessment area were directed to return up to three times before the session ended. Sessions were terminated in this manner for Neil and Andrew during the reinforcer evaluation phase of the study. Data from the portion of the evaluation completed prior to termination are reported in both cases.

Each participant continued through the sequence of assessment methods until a minimum hierarchy of preferred items (i.e., high and low) was produced or the FO assessment resulted in exclusive engagement with one stimulus. Across methods, a high-preference stimulus was identified if a single toy was selected during a higher

percentage of trials than any other item in the pool. A low-preference stimulus was defined as the item that was selected during fewer trials than any other item in the pool. The low-preference stimulus had to be selected and associated with some amount of appropriate engagement per trial in order to be included in the reinforcer evaluation phase. A minimum preference hierarchy, then, was defined as the identification of one high-preference item and one *relatively* low-preference item. Specific decisions to move from one method of preference assessment to a modified variation or new method were determined based on the occurrence of the barriers described in Table 2.

Table 2

Barriers to Successful Stimulus Preference Assessment Outcomes

Method	Barrier	Definition
MSWO	Positional bias via failure to scan	Greater than 50% of responses to the item in a single position (i.e., far left, far right, middle) when participant fails to follow experimenter prompt and visually orient to all stimuli prior to selection
PS	Positional bias (Left-Right)	Participant makes >50% of selections to one side
SSE	See section on "All Methods"	See section on "All Methods"
FO	See section on "All Methods"	See section on "All Methods"
All methods	Prohibitive problem behavior	3 consecutive trials with dangerous, disruptive, or noncompliant problem behavior
	Discrepant reinforcer evaluation results (not attributable to other barriers)	Undifferentiated or discrepant results suggesting similar or inverse reinforcing values of high- and low-preference stimuli

Preference Assessment Procedures

Multiple-Stimulus (Without Replacement) Assessment

Procedures for the MSWO procedure were modeled after those described by Carr, Nicolson, and Higbee (2000). The MSWO assessment began with the experimenter placing all stimuli horizontally in an array on the table such that each

stimulus was equidistant from the participant and every other stimulus. Each stimulus was placed at least 5 cm from neighboring stimuli. Prior to each trial, the experimenter established eye contact with the participant and prompted him or her to orient to all stimuli ("Mike, look.") by making a sweeping gesture from one end of the array to the other. The participant was then instructed to make a choice ("Pick one.") and a 5-s delay was allowed prior to additional prompts. Prompts were repeated only when a participant failed to respond on the first trial of the day. When this occurred, the instruction was repeated up to two additional times in an effort to evoke an initial response. If the participant still failed to make a selection response following two verbal instructions on the first trial of the day, a partial-physical response prompt was provided in conjunction with the third, and final, instruction such that the participant's hand was moved uniformly closer to all stimuli without biasing him or her to select a specific item. This level of prompting was required for just one participant over the course of the study (i.e., Jared) and was sufficient to facilitate his participation. Selection responses were followed by the immediate delivery of the relevant item and a 30- s access period. Experimenter-participant interactions were kept to a minimum during this interval and were consistent across trials (e.g., "You picked ___"), with the exception of social activities (e.g., playing catch, tickling, singing). Attempts to select more than one stimulus per trial were blocked. Between trials, the order in which stimuli were presented in the array was randomized such that stimuli from the left side of the array were rotated to the far right side. These steps were repeated until all stimuli were selected or none of the remaining stimuli were selected within 20 s of the most recent instruction to choose.

If a participant did not engage in scanning (i.e., respond to gestural prompts to orient to all stimuli by shifting his or her gaze from one end of the array to the other) on the majority of trials for the first array of the MSWO, a scanning deficit was noted. In this case, the stimuli were placed in a toy box which allowed the participant to orient to each available stimulus without engaging in lateral scanning. Procedures for this MSWO (Toy Box) assessment were identical to those described for the initial MSWO except that scanning prompts were omitted and items were selected from the toy bin rather than from a horizontal array.

In the event that a minimum hierarchy of preferred items was identified but the reinforcer evaluation did not corroborate assessment results, the progressive model dictated that experimenters complete a new RAISD with the original informant. Endorsements of a greater range of preferred stimuli would be specifically solicited (e.g., "Name something that Sam likes to play with every once in a while."). This step was designed on the assumption that a lack of agreement between preference and reinforcer assessments when other barriers were eliminated could be indicative of a skewed pool of stimuli. In other words, it is possible that all of the caregiver nominated items were similarly and highly preferred. The inclusion of a control stimulus very likely minimized such outcomes in the current investigation. Had a second RAISD been completed for any participant, the experimenters planned to return to the most recent, failed assessment method and attempt to produce a verified outcome with the new set of stimuli.

Paired-Stimulus Assessment

The PS preference assessment procedures planned for this study were based on those described by Fisher et al. (1992). Prior to each trial, the experimenter was to establish eye contact with the participant in the manner previously described before presenting a new pair of stimuli and saying, "Pick one." All aforementioned procedures relating to the repetition of instructions, response prompts, and response blocking were included. Pairs of stimuli from earlier assessment attempts would be presented side-by-side, within 10 cm, on the table. Items included in each pair and item placement on the right or left side would be alternated such that 1) every stimulus was presented with every other stimulus, and 2) the presence of a side bias would not produce false positive rankings for a stimulus presented more frequently on the right or left side.

While the PS assessment was not required to produce a verifiable, minimum hierarchy of preferred stimuli for participants completed to date, the following criteria were established for progressing through this phase of the model. As before, discrepant results between the PS assessment and the reinforcer evaluation would result in the experimenter revisiting the RAISD with informants to identify a wider range of relatively preferred activities. Following completion of the second RAISD, experimenters would return to the PS assessment method and attempt to produce a differentiated outcome with the new set of caregiver-nominated stimuli.

If the participant was observed to make more than 50% of selection responses to stimuli on the right or left side, the possibility of a side bias would be assessed. Up to two sessions, consisting of four trials each, would be implemented to determine the need to modify or abandon the PS method. The procedures would involve two items

(one control, one caregiver-nominated) from outside the pool of assessment stimuli to probe whether the side bias existed for selection responses in the presence of paired stimuli presented farther apart on the table (e.g., 20 cm). The position of the purportedly reinforcing stimulus would remain in the location opposite the favored position. If the participant did not select the alternative stimulus over the control stimulus on the majority of test trials (75% or more) during which stimuli were presented in a wide format, the experimenter would then assess whether the bias existed when stimuli were held up vertically before the participant. For this assessment, the control stimulus and the endorsed stimulus would alternate between high and low positions. If the control stimulus was not selected on the majority of test trials (at least 75%) during which alternative stimuli were presented vertically, the experimenter would proceed to the SSE preference assessment.

Single-Stimulus Engagement Assessment

Again, the SSE assessment was not ultimately among those required to produce a verifiable, minimum hierarchy of preferred stimuli for participants included in this study. Had this assessment method been necessary, procedures would entail presenting stimuli, one at a time, and measuring the duration of appropriate participant interaction over a 2-min period for each item (DeLeon et al., 1999; Piazza et al., 1996b). As before, appropriate interaction would be defined as physical contact between the participant and a particular stimulus and the absence of inappropriate manipulations.

The progressive model dictated completion of a second RAISD to identify a new pool of relatively preferred items in cases where all items appear to be equally reinforcing during the SSE assessment (i.e., continuous engagement with all stimuli or

low-ranking stimulus from assessment becomes the high-ranking stimulus during reinforcer evaluation). Following this step, the SSE assessment was to be repeated using new stimuli.

Free-Operant Assessment

The FO preference assessment was implemented with all participants who exhibited prohibitive levels of problem behavior (dangerous, disruptive, or noncompliant behavior on three consecutive trials) in one of the aforementioned methods. Procedures for the FO preference assessment were based on those described by Roane et al. (1998). The experimenter was present but did not interact with participants during the 5-min FO assessment period. Prior to the assessment, preferred stimuli were arranged on a table. For Austin and Jonah, stimuli were arranged equidistant from the participant on the floor. The assessment began when the experimenter led participants to the assessment area. Participants then had the opportunity to interact freely with one or more stimuli for the duration of the assessment. The experimenter did not prompt participants or restrict their access to stimuli at any point. The cumulative duration of engagement, measured in seconds, was recorded for each stimulus with which the participant maintained physical contact and refrained from inappropriate manipulation and problem behavior. This value was then converted the percentage of the session with engagement by dividing the cumulative duration by 300 s and multiplying by 100.

The stimulus corresponding to the highest percentage of the session with engagement was evaluated in comparison to the stimulus corresponding to the lowest percentage with engagement. In order to be included in the reinforcer evaluation, low-

preference stimuli had to be associated with at least 50% of the cumulative duration of engagement observed with high-preference stimuli. In the event that a participant allocated responding exclusively to one stimulus, that item was compared to a control option (i.e., chair with no toy) in the concurrent-operant reinforcer evaluation. A verified outcome, in this case, was defined as participants spending a greater proportion of time in the chair associated with the high-preference stimulus relative to the control chair. If the inverse was observed, a second RAISD interview was planned followed by a second attempt to identify a verifiable high-preference item with the FO assessment.

<div style="text-align:center">Reinforcer Evaluation Procedure</div>

A concurrent-operant preparation was used to test the relative reinforcing effects of stimuli identified as high- and low-preference according to the aforementioned criteria for each assessment method. Reinforcer evaluation procedures were closely adapted from those described by Fisher et al. (1992), Piazza et al. (1996a), and Roane et al. (1998). Pre-training for the reinforcer evaluation was conducted in a discrete-trial format for all participants except Josh and Neil. Pre-training was not conducted with Josh due to experimenter error. In Neil's case, his disruptive behaviors (e.g., property destruction, throwing things, screaming) in response to experimenter instructions and prompts after the first, unprompted pre-training trial required that the experimenter terminate training. Neil's sessions were conducted in his primary caregiver's apartment and she expressed concerns that his behaviors during this portion of the session may cause property damage or inconvenience neighbors. The target response for all participants was in-chair behavior. Three chairs were arranged along a rectangular table, at least 0.5 m apart. Each trial consisted of the experimenter placing a moderately

preferred stimulus from previous preference assessments on the table in front of two chairs and leaving the third chair empty. Again, chairs were arranged in the absence of a table and relevant toys were placed in the seat of each chair for two participants. The experimenter pointed to each chair and provided the instruction, "You can sit here and have this, you can sit here and have this, or you can sit here and have this. Pick one" following which the participant was allowed up to 5 s to sit in a chair and access an item. If the response did not occur, physical guidance was used to prompt the participant to sit down in 1 of the 3 chairs. When he or she sat, the preferred stimulus was delivered for 10 s or until the participant left the chair. Stimulus locations were randomized across chairs throughout training, as were experimenter prompts toward specific chairs and associated stimuli. Training trials continued in this manner until the participant independently sat in a chair on three consecutive trials within a single training session.

Reinforcer evaluations were 9 min in duration and were conducted either 1) immediately following the successful preference assessment (i.e., two assessment maximum per participant, per day) or 2) during a session scheduled no more than three days following the successful assessment. Efforts were made to restrict participant access to the identified high- and low-preference items during this delay, though this was not possible for all participants.

During the concurrent-operant evaluation, participants had access to three chairs. Each chair corresponded to the availability of a high-preference stimulus, a low-preference stimulus, or no stimulus. At the beginning of the session, participants were positioned equidistant from the three chairs and the experimenter pointed to each chair

and provided the instruction, "You can sit here and have this, you can sit here and have this, or you can sit here and have this. Pick one." The experimenter did not provide any additional prompts for the participant to make a selection. In the event that the participant attempted to remove a stimulus from a particular chair location, the experimenter blocked the response and replaced the stimulus. Similarly, the experimenter blocked all attempts by the participant to engage with both stimuli simultaneously. After 3 min elapsed, the experimenter prompted the participant to return to the starting location, rotated the position of stimuli, and presented another opportunity to make a selection.

A relatively higher proportion of time spent in the chair corresponding to access to the high-preference stimulus (e.g., high point for the evaluation or clear separation between data paths) was determined to verify the preference assessment results.

Interobserver Agreement and Procedural Integrity

Two independent observers collected data on scanning, selection, placement, problem behaviors, and engagement on 20 to 100% of trials for each assessment type attempted with each participant. Due to a loss of videotaped data (i.e., footage recorded over), secondary measures were not available for Neil (all secondary data), Andrew (procedural integrity, IOA on duration engagement), Austin (IOA on duration engagement), Jonah (preference assessment procedural integrity, IOA for duration engagement), or Isaac (IOA on pre-training for reinforcer evaluation). Finally, reliability data on duration engagement and procedural integrity for Steve's reinforcer evaluation were not collected because the secondary observer was unexpectedly called out of the room during session. Interobserver agreement (IOA) was calculated using the

formula for overall agreement with MSWO assessments (agreements divided by agreements plus disagreements and multiplied by 100). Interobserver agreement was calculated using the formula for total agreement on all FO assessments and reinforcer evaluations (low duration in-seat or engaged divided by high duration in seat or engaged and multiplied by 100).

The following method-specific measures of IOA were obtained. Interobserver agreement was assessed for all measures during 100% of MSWO trials for all but one participant. In Andrew's case, reliability on the aforementioned measures was assessed for just 20% of trials. Interobserver agreement on scanning behavior averaged 99% (range, 50% to 100%). For item selection, an agreement was scored when the primary and secondary observers recorded that an item was selected in the same order (i.e., received the same rank). Interobserver agreement on item selection averaged 97.7% (range, 80% to 100%). For item placement, an agreement was scored when primary and secondary observers marked the same placement on a positional grid for item selection per array. Mean IOA on item placement was 91.8% (range, 55% to 100%). Reliability measures on placement were above 90% in all but two cases. For both Troy (71% IOA on placement) and Mark (55% IOA on placement), data collectors differed in scoring by one placement to the right or left for each trial on which a disagreement was identified. If the criterion for agreement is relaxed to reflect proportion of trials for which independent observers agreed on selections to the right, middle, and left, IOA measures would uniformly increase to 100% for this measure. Finally, IOA on problem behavior averaged 95.8% (range, 73% to 100%) during MSWO assessments.

Two independent observers collected data on participant performance during pre-training for reinforcer evaluations for 14 of 15 relevant participants (93% of total participants). Training data for Isaac were among those lost when portions of two videotapes were recorded over. For the remaining participants, reliability data for pre-training were collected on 25 to 100% of trials and mean IOA was 99.4% (range, 91.7% to 100%).

Interobserver agreement was collected for 100% of FO assessments and reinforcer evaluation sessions for 2 of 4 (50%) relevant participants. It should be noted that problem behaviors were never observed during FO assessments. Average IOA on cumulative duration of engagement for FO assessments was 96.8% (range, 93.6% to 100%). Average IOA on in-seat behavior for reinforcer evaluations was 96.5% (range, 86.4% to 100%). For reinforcer evaluations, problem behavior occurred with two participants and consisted of three attempts to leave the assessment area after being prompted to return. Agreement on the occurrence of these behaviors was 100%.

To confirm that the experimenters' implementation of procedures for each assessment type and the reinforcer evaluations was consistent with the written protocol, procedural integrity data were also collected for 100% of trials across methods for all participants except Neil, Andrew, and Jonah. For FO assessments, reliability data were collected for the entire 5 min session. Experimenter behaviors evaluated for procedural integrity during MSWO assessments included 1) providing 30-s access to all stimuli prior to the first assessment conducted with each participant, 2) randomizing stimulus placement across trials, 3) maintaining a consistent access period of 30 s for each selected stimulus, and 4) removing stimuli from the array following selection.

Experimenter behaviors for FO and concurrent-operant reinforcer evaluations were 1) refraining from interaction with participants during all assessment and evaluations, 2) delivering appropriate prompts and consequences (reinforcer evaluation training, only), 3) randomizing item placement (reinforcer evaluation, only), and 4) prompting orienting (reinforcer evaluation, only). The number of occasions a designated procedure was correctly implemented was divided the total number of opportunities the experimenter had to implement the specific procedure and multiplied by 100. Average procedural integrity for MSWO assessments was 98.6% (range, 91.7% to 100%). Average procedural integrity for FO assessments was 100%. Mean procedural integrity for reinforcer evaluations was 99.4% (range, 91.7% to 100%).

Interobserver agreement on procedural integrity was also assessed for 100% of the MSWO trials conducted with 5 participants (29% of total participants) and FO trials conducted with 1 participant. For MSWO and FO assessments, average IOA on procedural integrity was 92.5% (range, 75% to 100%). For reinforcer evaluations, reliability of procedural integrity data was assessed for 4 participants (23% of total participants). Average IOA on procedural integrity during reinforcer evaluations was 100%.

RESULTS

A total of 17 children with developmental disabilities completed the study. The

majority of participants (76%) progressed to reinforcer evaluations based on results

from the initial MSWO assessment. Results from those reinforcer evaluations verified

the outcomes of the preference assessments in all but one case. One of the 12 reinforcer

evaluations following the initial MSWO was terminated prematurely (i.e., during the

first 3-min trial) because the participant, Neil, left the session area on three occasions

after being directed to return.
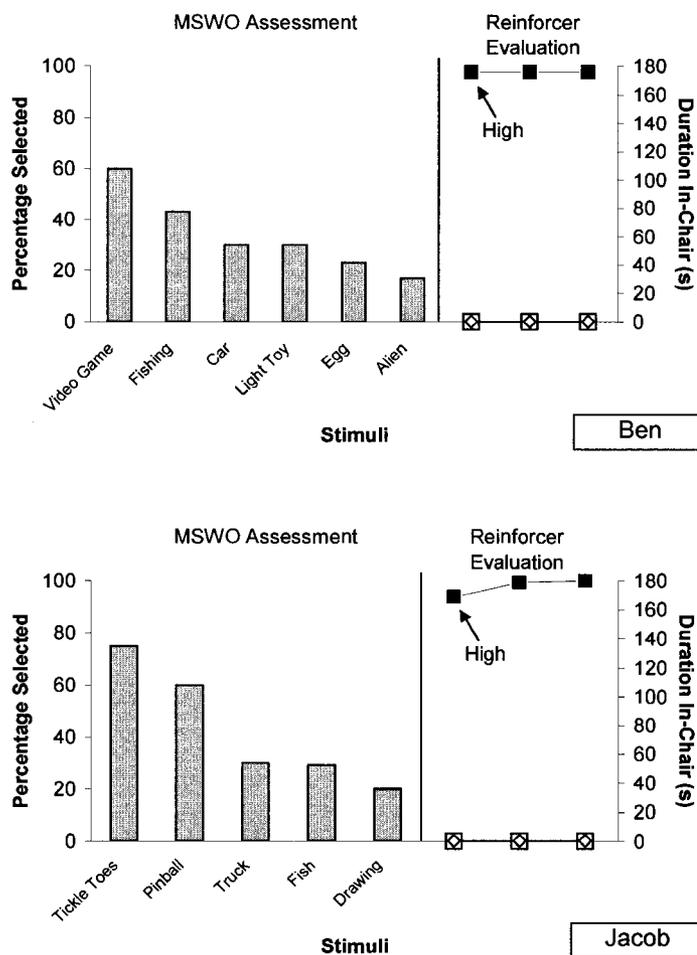
Figure 2. Verified participant data from MSWO preference assessments.

Figure 2 - continued
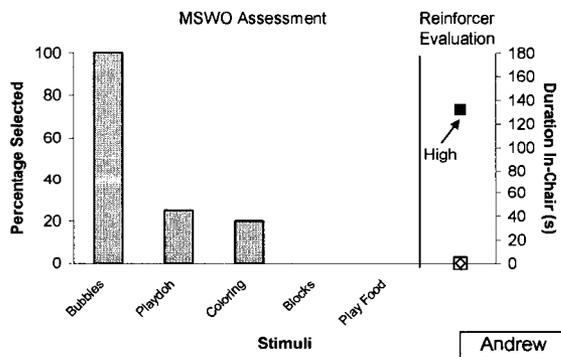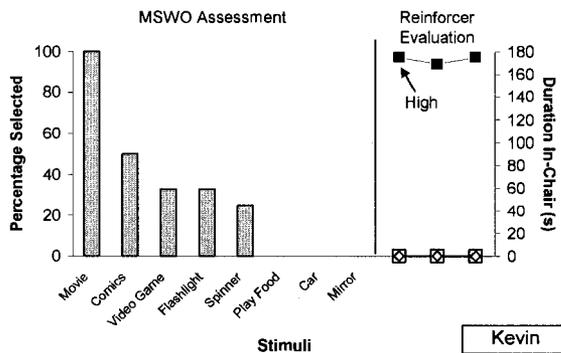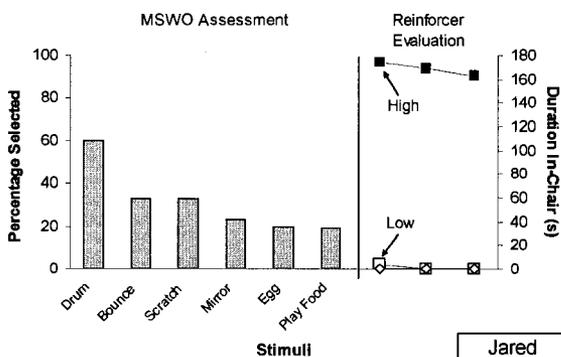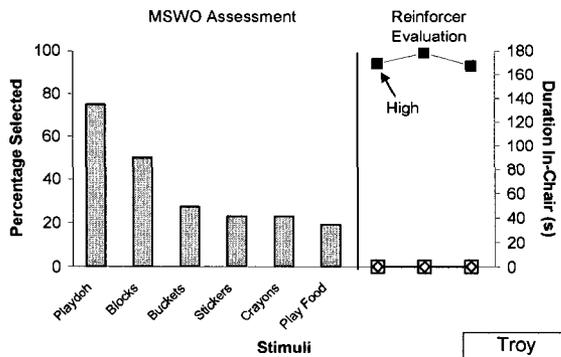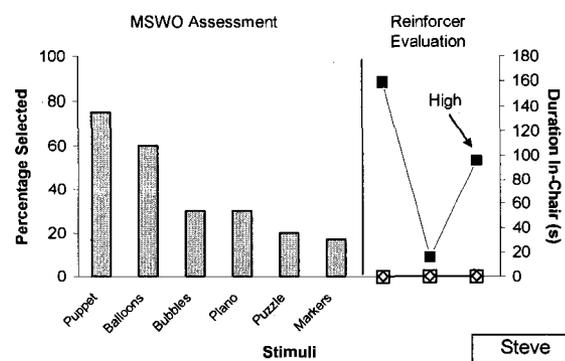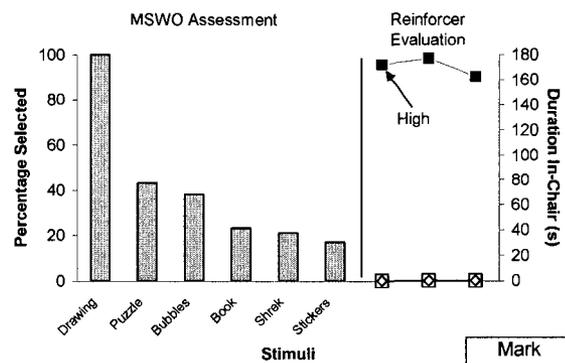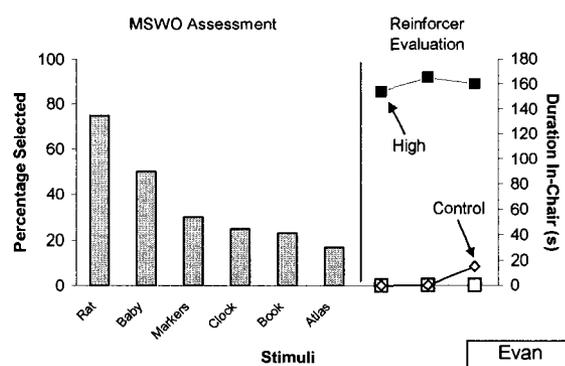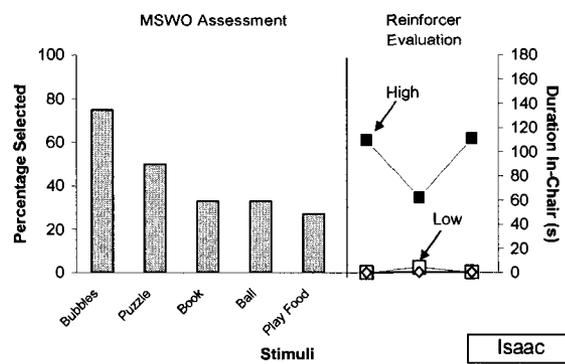
Figure 2 - continued

Figure 2 - continued
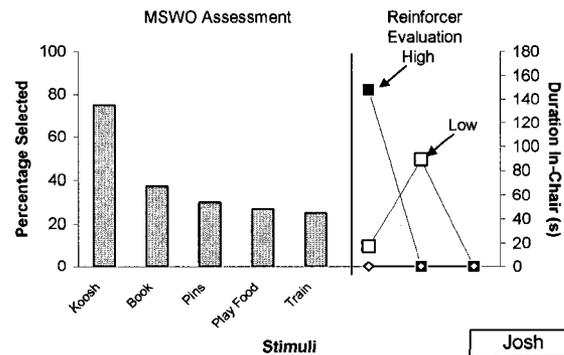
Brandon's reinforcer evaluation did not corroborate the findings from his preference

assessment (see Figure 3). A positional bias was identified during the evaluation that

might at least partially account for these findings. In addition, Brandon's reinforcer

evaluation was complicated by the fact that he engaged in relatively high levels of

stereotyped finger-flicking (M = 17.5% of each 3-min trial) and running behaviors that

competed with in-seat behaviors. Specific data on running are not reported because

Brandon typically moved outside the view of the video camera. In other words, he

spent the smallest portion of the 9 min evaluation sitting in the far right chair and the

remaining time running in the middle of the assessment area rather than interacting with

the toys. Based on this analysis, it is unlikely that a skewed pool of stimuli resulted in

the discrepant reinforcer evaluation findings for Brandon. Thus, a second RAISD was

not completed in his case.
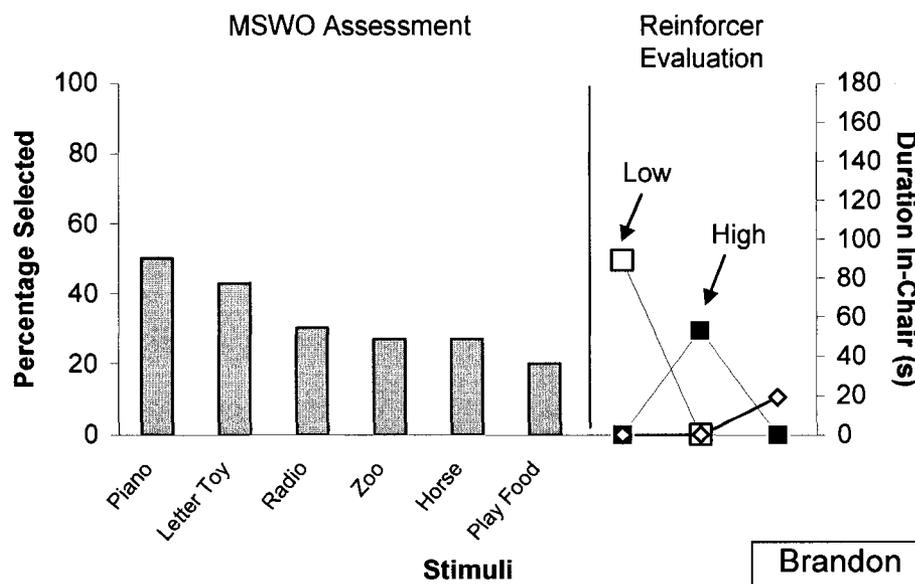
Figure 3. Discrepant participant data from one MSWO preference assessment.

Of the five participants for whom barriers were identified during the initial

MSWO assessment, 4 participants (80%) engaged in prohibitive levels of problem

behavior and 1 participant did not complete the MSWO assessment based on a failure to

scan, resulting in a positional bias. Hannah failed to engage in a scanning response and

selected the extreme right item on 100% of trials during the first array of her MSWO.

Based on this observation, the MSWO (Toy Box) method was introduced. This

approach to eliminating the need for scanning was effective in identifying a verifiable

hierarchy of preferred stimuli for Hannah.
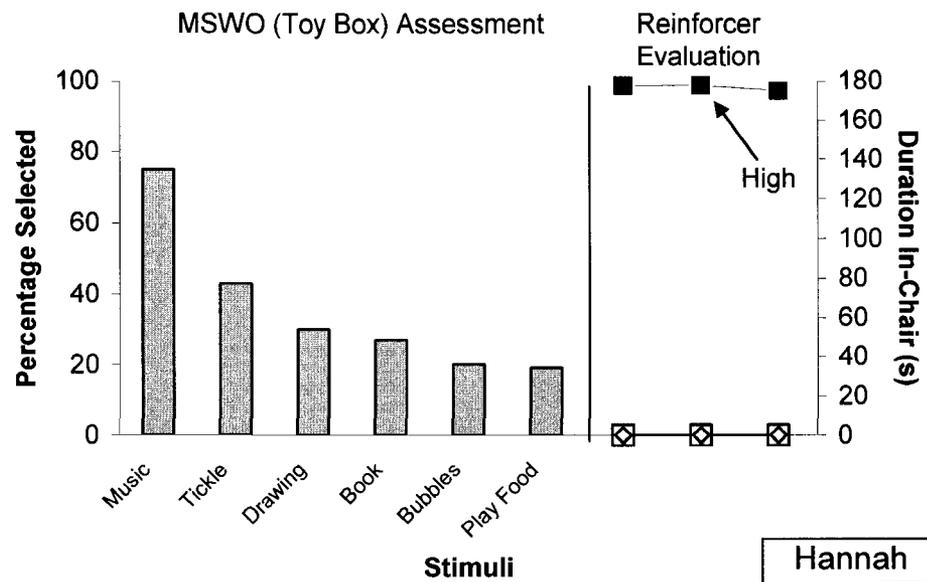
Figure 4. Verified participant data from MSWO (Toy Box) assessment.

The FO assessment was implemented in response to problem behavior for all remaining

cases (23% of total participants). Topographies of problem behavior during the initial

MSWO included noncompliant behavior (dropping to the ground) for Luke and Austin

and disruptive and noncompliant behaviors (i.e., throwing toys, holding toys after the

access period, elopement) for Neil and Matthew. FO assessments provided information

on at least one high-preference item for 100% of the participants exposed to this

method. One of the four reinforcer evaluations was terminated prematurely (i.e., during

the first 3-min trial) because the participant left the session area on three occasions after

being directed to return. Results from Matthew's original reinforcer evaluation were

discrepant with his preference assessment outcomes. This was not surprising given the

similar proportion of time that Matthew spent interacting exclusively with the piano

(32% engagement) and book (41% engagement) during his FO assessment. Based on

this outcome, a criterion was established wherein high-preference items identified with

the FO method had to be associated with at least twice the duration of interaction

recorded for the low-preference item in order for both to be included in the reinforcer

evaluation. Due to the passage of time since Matthew's initial FO assessment, the

procedure was repeated using the same stimuli. Two different toys (puzzle and Blue's

Clues© radio) were found to meet the aforementioned criteria (56% and 20%

engagement, respectively). The concurrent-operant reinforcer evaluation verified this

outcome.
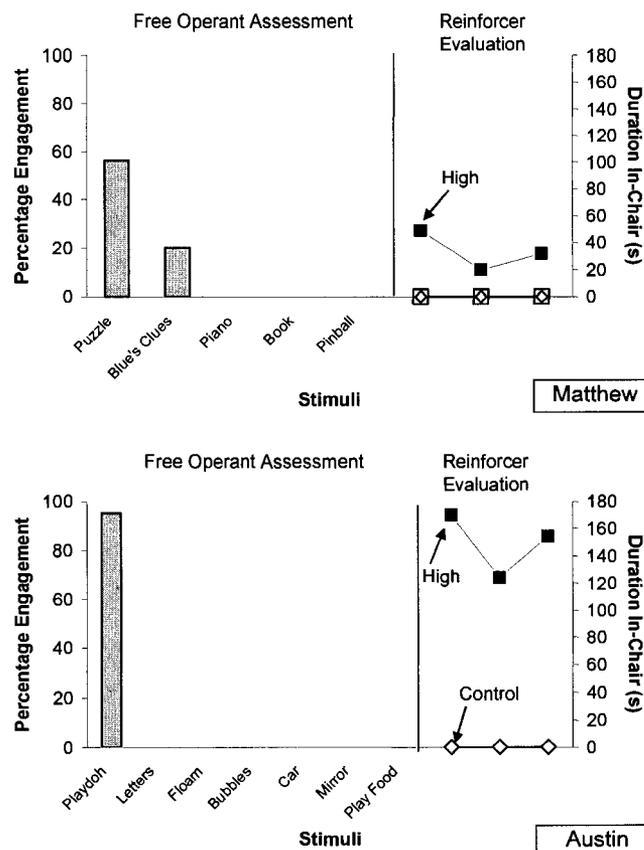
Figure 5. Verified participant data from FO assessments.

Figure 5 - continued

Free Operant Assessment

Reinforcer Evaluation

Percentage Engagement

100
80
60
40
20
0

Duration In-Chair (s)

180
160
140
120
100
80
60
40
20
0

High

Low

Car Ball Fish Bubbles Drawing

Stimuli

Neil

Free Operant Assessment

Reinforcer Evaluation

Percentage Engagement

100
80
60
40
20
0

Duration In-Chair (s)

180
160
140
120
100
80
60
40
20
0

High

Control

Mirror Music Toy Bubbles Play Food Slinky

Stimuli

Jonah

Overall, results from this investigation were relatively homogenous. The MSWO assessment was effective for the majority of participants. In Hannah's case, a minor modification of the MSWO method was sufficient to minimize the influence of her scanning deficit. For participants who engaged in prohibitive levels of problem behavior, the FO assessment effectively identified 1 to 2 relative reinforcers in every case. Table 3 provides a summary of effective methods per participant, barriers, and high/low stimuli identified.

Table 3

Assessment Results per Participant: Outcomes (High, Low) and Suspected Barriers

Participant	MSWO	MSWO (TOY BOX)	FO
Matthew	*Terminated - PB*		*Puzzle, Blue's Clues*
Jacob	*Tickle Toes, Drawing*		
Ben	*Video Game, Alien*		
Jared	*Drum, Play Food*		
Brandon	*Piano, Play Food*		
Troy	*Playdoh©, Play Food*		
Kevin	*Movie, Video Game*		
Josh	*Koosh©, Trains*		
Austin	*Terminated - PB*		*Playdoh©, Control*
Andrew	*Bubbles, Coloring*		
Neil	*Terminated - PB*		*Ball, Fish*
Isaac	*Bubbles, Plastic Food*		
Jonah	*Terminated - PB*		*Mirror, Control*
Evan	*Rat, Atlas*		
Steve	*Puppet, Puzzle*		
Mark	*Puzzle, Drawing*		
Hannah	*Terminated - Scanning / Bias*	*Music, Book*	

Results from the current sample of participants suggest that the progressive model for conducting preference assessments may be significantly shortened in the majority of cases. A larger sample of participants may yield different results. However, the present findings indicate that teachers and practitioners may expect to attempt no more than two methods with a particular child before identifying an effective and valid approach to preference assessment.
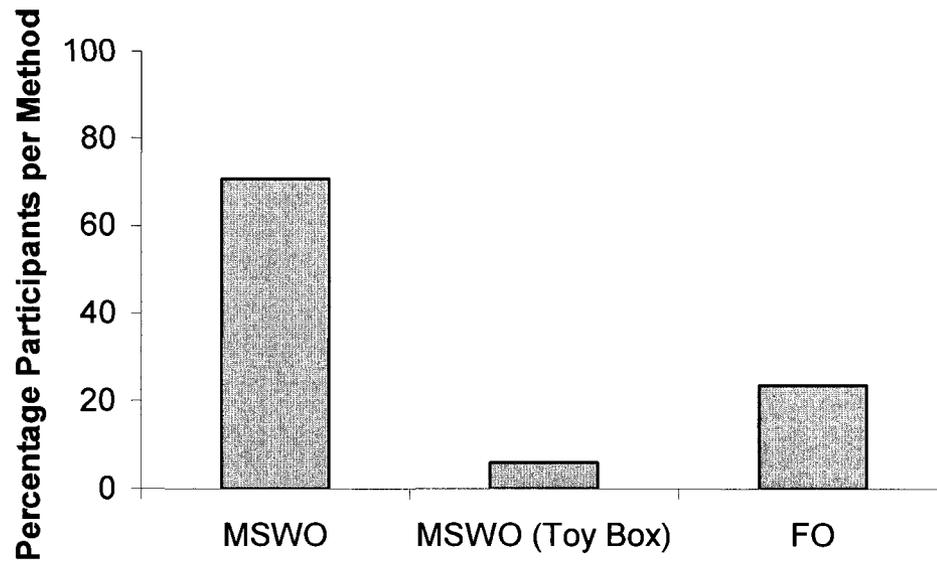
Figure 6. Percentage of participants completed with each SPA method.
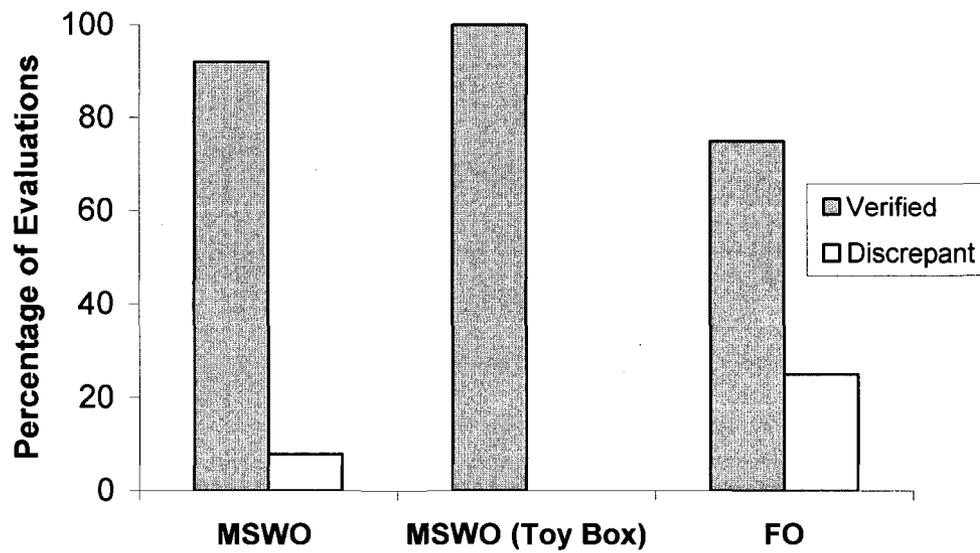
Figure 7. Percentage verified and discrepant reinforcer evaluation results per method.
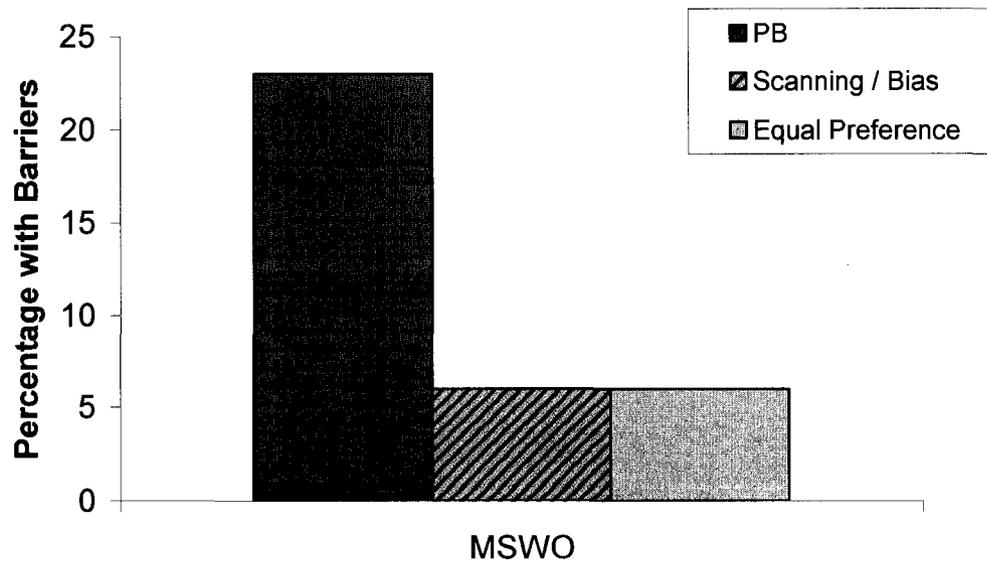
Figure 8. Percentage of MSWO assessments with specific barriers.
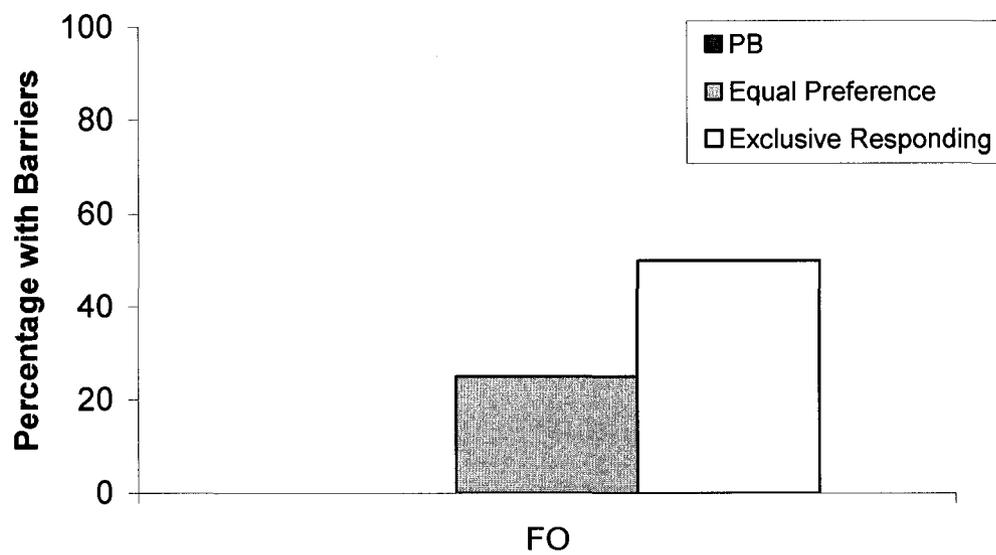
Figure 9. Percentage of FO assessments with specific barriers.

DISCUSSION

The purpose of this investigation was to evaluate a progressive model for conducting preference assessments when a minimum hierarchy of reinforcers is sought (i.e., for teaching purposes). The utility of the model was evaluated according to several measures including percentage of verified outcomes and percentage of barriers identified per method. Overall, the model effectively detected and eliminated predicted barriers and identified at least one reinforcer in 100% of cases.

While the progressive model described in this study is a potentially helpful resource for educators and clinicians, several aspects of the investigation merit closer examination. First, the pool of participants was not evenly distributed in terms of diagnosis and participant history of preference assessments was not controlled. The participants were uniformly diagnosed with pervasive developmental disabilities. This factor may limit the degree to which results can be expected to generalize to other disabled populations. For example, it is possible that individuals with more significant cognitive impairments, overall, may exhibit fewer prerequisite skills including basic compliance and scanning repertoires. Such participants may be more likely to require PS or SSE methods. Participants also had varying levels of experience with preference assessments. While the hope was to recruit children who had minimal history with these procedures, 53% of the participants were exposed to some variation of an MSWO or FO preference assessment on a weekly basis. Of the participants who were redirected to the FO assessment based on problem behavior, 3 of 4 did not have an extensive history with preference assessments. It is unknown whether a participant pool

comprised of children with less exposure may yield different findings with respect to the utility of the MSWO assessment.

Another limitation of the study is that the criterion for a useful preference assessment outcome was specific to teaching situations. Specifically, the objective of the investigators was to identify at least two relatively preferred stimuli. Undoubtedly, different clinical applications for preference assessment data would be better served by different progressive models. One clear example is identification of competing items to reduce problem behavior. In order to facilitate data collection on engagement and levels of problem behavior with each stimulus, the SSE method would likely assume the eminent position in the model. Because results from this study only have implications for cases in which at least two relative reinforcers are required, future investigations should seek to evaluate models with alternative functions.

A third limitation is that systematic efforts were not made to restrict participant access to items prior to preference assessments. The fact that a minimum hierarchy of preferred items was identified in the vast majority of cases suggests that this limitation did not have a substantial impact on the results. Even so, future investigations may conduct a more conservative evaluation of this or similar models by holding the degree of deprivation constant across stimuli and participants.

Fourth, it is possible that the utility of MSWO (Toy Box) and FO assessments was a product of participant history with the MSWO assessment. Such effects might be mediated by item exposure during preliminary assessments or training functions of those assessments (e.g., participants learn to scan, select, etc.). Related to the first possible explanation, it is probable that item preferences are at least partially established

as a function of repeated opportunities to engage and contact the reinforcing properties of those items. For example, Hanley et al. (2006) were able to produce shifts in stimulus ranks associated with low-preference stimuli by pairing those stimuli with other reinforcers (e.g., soda, salty snack foods). In addition, data for 1 of 2 participants suggested that increased exposure to two low-preference stimuli in the absence of pairing procedures also resulted in increased preference. It is unlikely that item exposure facilitated the outcome of second attempts at preference assessment in the current investigation because participants had the standardized opportunity to contact stimuli for 30 s prior to the first assessment attempt and subsequently accessed each item a maximum of two times. The second account seems relatively unlikely because each participant in this study advanced from the initial assessment to other methods in an average of 4 trials (range, 3 to 6 trials) of the unsuccessful approach. A possibility for future research evaluating the degree to which history of assessment plays a role in assessment outcome would involve counterbalancing the order in which assessments are presented across participants. Results could then be discussed more confidently in terms of the most effective initial methods.

Fifth, the role of a second RAISD was likely underrepresented in the current investigation as a byproduct of the control toy that was included for the majority of participants. Hence, results from this study may underestimate the proportion of cases in which equal preference for stimuli, or skewed stimulus pools, hinder verifiable preference assessment outcomes. While the primary objective of this study was to remedy within- and between-method barriers given a suitable range of preferred stimuli,

future studies may examine the degree to which caregiver report is accurate and adequate in this regard.

Another limitation of this study is related to the method of reinforcer evaluation. Given time constraints, the concurrent-operant reinforcer evaluation offered an efficient means to verify the relative reinforcing effects of high- and low-preference stimuli. As it was previously discussed, this procedure did not assess the degree to which either stimulus functioned as an effective reinforcer in absolute terms (i.e., sufficient to maintain a clinically relevant response). Alternative methodologies (e.g., single-operant reinforcer evaluation) would be needed to evaluate the degree to which high- and low-ranking stimuli function as effective and durable reinforcers.

Despite the aforementioned limitations, data collected to date suggest that the progressive model was generally effective and that the PS and SSE methods of preference assessment may constitute unnecessary components for teaching purposes. Specifically, it may be the case that MSWO assessments, with or without slight modifications, are likely to produce useful outcomes for all individuals who would otherwise succeed with the PS method. Further, it is possible that the SSE method represents too subtle a variation of other available methods (i.e., free-operant) to be relevant for the majority of learners when identification of a minimum hierarchy of reinforcers is the primary goal. Again, it is possible that a larger group of participants would yield a different distribution. The possibility that a simplified model is suited to the needs of most learners will be further evaluated as additional participants complete the current study.

Several possibilities for future research on the utility of this progressive model should also be considered. For example, it may be beneficial to empirically establish more stringent criteria for identifying a hierarchy of relative preferences (e.g., minimum criteria for differential engagement or selection percentages across methods). This could be achieved by conducting preference assessments with a group of participants, exhaustively testing outcomes using single-operant reinforcer evaluations and clinically relevant responses, and generating predictive criteria based on these aggregate data. These criteria could be used to guide future research in the area and to assist educators and clinicians in reinforcer identification. In addition, research on the acceptability, practicality, and clinical utility of the current model in applied settings should be examined. Specific questions might include whether teachers and direct-care staff can be taught to implement the model with accuracy and whether access to the model influences the frequency with which preference assessments are conducted.

It is possible that other approaches to method selection for preference assessments would be more effective or practical than the progressive model. Alternative solutions may include assessing learner prerequisites prior to assessments and basing method selection on these data. Such prerequisite repertoires have not been identified or researched in the empirical literature. However, data from this study offer preliminary support for scanning and basic compliance with gestural prompts as potentially critical pre-requisites for the MSWO method.

Another solution to the problem of method identification would be to uniformly prescribe frequent FO or single-array MSWO assessments. This simple solution is generally supported by conclusions from this evaluation of the progressive model (i.e.,

that a small number of methods should be effective for the vast majority of clients). One potential limitation, as it was previously discussed, may be related to the fact that brief FO assessments are less likely to produce information about a hierarchy of relative preferences sometimes required for teaching purposes. Roane et al. (1998) observed exclusive responding in approximately half of their participants and the same held true for participants in this investigation. Methods from response-restriction analyses have been used to eliminate this potential barrier while maintaining the benefits of FO assessments with respect to problem behavior. Hanley, Iwata, Lindberg, and Conners (2003) conducted a series of 5-min FO assessments during which the item associated with the highest levels of engagement during one session was eliminated during the next 5-min session. While this approach increased the probability of identifying a fully differentiated hierarchy of preferred activities for 3 adults with developmental disabilities, it was substantially more time-consuming and technically cumbersome than typical FO and brief MSWO methods. In addition, the FO assessment was also sufficient for identifying two relatively preferred stimuli (i.e., a minimum hierarchy) across participants. Even so, the utility of traditional FO assessments may be enhanced for some individuals with the addition of one response-restriction session following instances of exclusive responding. Directions for future research on this matter may include integrating a response-restriction procedure into the progressive model and evaluating the efficacy and acceptability of the progressive model against the uniform recommendation to use modified FO assessments whenever one or two preferred stimuli are sought.

One general direction for the progressive model for preference assessments and the brief functional analysis model from Vollmer et al. (1995) may be to serve as templates for other prescriptive models. In the way that literature reviews inform a professional research audience on findings in a particular area, these practical models may serve to consolidate technological information and inform practitioners and educators. Any clinical outcome that can be effectively achieved via different methodological avenues and requires integration of certain research-informed considerations may be suitable for adaptation to this type of a model. Specific possibilities seem to include a model for facilitating the transfer of stimulus control (e.g., prompt-fading, differential reinforcement, error correction) and a model for selecting among methods for establishing chains of behavior (i.e., total task presentation, forward chaining, backward chaining). Clearly, a single model would not be expected to direct all clinical decisions for all clients. Furthermore, clinicians should be advised against all contraindicated applications of such models or information, therein (e.g., high-risk clients). On a related note, as in the case of Vollmer's functional analysis model, some algorithms would be intended for more specialized, professional audiences than the progressive model for preference assessments. While prospective applications for this approach to packaging and disseminating behavior analytic technologies are interesting to consider, empirical data are needed to confirm whether this and similar models are ultimately accessible and useful to the target audience (i.e., educators and clinicians who may not contact the extant empirical literature).

At present, several steps are being taken to recruit additional participants for the evaluation of the progressive model for conducting preference assessments. Fliers have

been distributed across clinics in a multidisciplinary facility for individuals with special needs to facilitate recruitment of participants with diagnoses other than pervasive developmental disabilities. In addition, efforts will be made to recruit children with lower levels of cognitive functioning. Specifically, schools and residential facilities for children and adolescents with severe disabilities will be contacted about the possibility of participating in the investigation. A second function of contacting school systems and long-term care facilities is to recruit individuals who may be less likely to have extensive history with formal preference assessments. The terminal goal for the study will be to recruit a minimum of 30 participants, in total, with the majority of new participants exhibiting more significant cognitive impairments and less intensive treatment history than the current pool.

In sum, the current study offers an effective, if preliminary, means for educators and clinicians to select and modify common methods of preference assessment in support of their teaching objectives. When more than one effective reinforcer must be identified, they can follow the progressive model to advance from the MSWO to MSWO (Toy Box) preparations until a hierarchy of likely reinforcers is produced. Teachers who have time and resources to conduct brief assessments on a more frequent basis may also make use of the FO method to minimize problem behavior and identify at least one effective reinforcer per administration. Future studies should seek to extend applications of this and similar models, thereby facilitating the dissemination and implementation of valuable behavioral technologies in applied settings.

Appendix A

Recruitment Flier

INVITATION TO PARTICIPATE IN A RESEARCH STUDY

We are members of the Psychology Department at Western Michigan University and we work with children who have autism and other developmental disabilities. We are currently conducting a study to evaluate toy preferences, and your child may have an opportunity to participate. We are hoping to find children between the ages of 3 and 12 who have some language impairments and are physically able to select (e.g., point or reach) and play with toys presented on a table in front of them. Children who participate in our study will participate in several variations of preference assessments in an attempt to find the most effective and time-efficient methods. In this study we will be evaluating toy preferences only. If you are interested in speaking to someone about the details of this study, please contact us.

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Appendix B

MSWO Data Sheet

MSWO Assessment

Participant: Date:

Observer: Primary / Secondary

Stimuli >>								
1	S PB	S PB	S PB	S PB	S PB	S PB	S PB	S PB
2	S PB	S PB	S PB	S PB	S PB	S PB	S PB	S PB
3	S PB	S PB	S PB	S PB	S PB	S PB	S PB	S PB
	/	/	/	/	/	/	/	/
% selected								

Position - Array 1   **Position - Array 2**   **Position - Array 3**

Procedural Integrity	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Appropriate prompts?														
Minimal interaction?														
30 sec access?														
Randomization?														
Total Integrity														
Procedural Integrity	15	16	17	18	19	20	21	22	23	24				
Appropriate prompts?														
Minimal interaction?														
30 sec access?														
Randomization?														
Total Integrity												/		%

IOA	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Selection per trial														
Placement per trial														
Problem behavior														
IOA	15	16	17	18	19	20	21	22	23	24				
Selection per trial												/		%
Placement per trial												/		%
Problem behavior												/		%

Sampling? Yes/No

Appendix C

FO Data Sheet

FO Assessment

Participant: Date:

Observer: Primary / Secondary

Stimuli ↓							Duration	% Interact.
1						PB	/ 300	
2						PB	/ 300	
3						PB	/ 300	
4						PB	/ 300	
5						PB	/ 300	
6						PB	/ 300	
7						PB	/ 300	
8						PB	/ 300	

Procedural Integrity	1	2	3	4	5	6	7	8		
Minimal interaction?										
5 min session?										
Total Integrity									/	%

IOA	1	2	3	4	5	6	7	8		
Duration per stimulus									/	%
Problem behavior									/	%

Engagement: Interaction with a single stimulus including physical contact between the item and participant hand, not including stereotyped or unsafe play

Problem Behavior: Instances of aggressive, self-injurious, or disruptive behaviors that present a physical risk or occur above a conversational volume

Appendix D

Reinforcer Evaluation Data Sheet

Pre-Evaluation Training

Participant: Date:
Observer: Primary / Secondary

1	I / P		1	I / P		1	I / P
2	I / P		2	I / P		2	I / P
3	I / P		3	I / P		3	I / P
4	I / P		4	I / P		4	I / P
5	I / P		5	I / P		5	I / P
6	I / P		6	I / P		6	I / P
7	I / P		7	I / P		7	I / P
8	I / P		8	I / P		8	I / P
9	I / P		9	I / P		9	I / P
10	I / P		10	I / P		10	I / P
Total	/10		Total	/10		Total	/10

Reinforcer Evaluation

Trials ↓	Most Preferred	Least Preferred	Control
1	/180	/180	/180
2	/180	/180	/180
3	/180	/180	/180

Trials ↓	Most Preferred	Least Preferred	Control
1	%	%	%
2	%	%	%
3	%	%	%

Procedural Integrity	1	2	3		
Prompt orienting?					
Minimal interaction?					
3 min trials?					
Randomize?					
Total Integrity				/	%

IOA	Most	Least	Control		
Trial 1 - Duration				/	%
Trial 2 - Duration				/	%
Trial 3 - Duration				/	%

Appendix E

Informed Consent Script

Sample Script for Contact with Parent

This script represents the content of ongoing contact with parents after they have responded positively to the recruitment flyer. All researcher-parent interactions during the informed consent and termination processes will take place via the phone, unless a face-to-face meeting is requested by the parent. The assent process will be completed at school in the presence of the classroom teacher for each participant.

a. Greeting and appreciation for interest

b. Introduction and statement of status (professor or student).

c. Description of the project and purpose

Would you like some information about the study? We are looking at a procedure to help teachers choose the best way to assess preferences for children who have language difficulties. We are using procedures that have been successful in other studies, but noone has tried to develop a way to identify the best approach for different children. Specifically, the procedures involve presenting participants with different toys that their parents say they enjoy and can play with safely. We record the order in which they choose among the toys and, in some cases, how long they spend playing with each one. This information tells us which toys are most preferred and best to use during instruction, and which toys are less preferred. Do you have any questions at this point?

c. Determination of eligibility

One of the things we have to do is identify children who fit the requirements for the study since the study would not be appropriate for all children. We are working with children who:

- *Have a diagnosis of a developmental disability such as autism or mental retardation*

- *Have some language impairments / difficulty accurately communicating their preferences*

- *Are between the ages of 3 and 12*

- *Would be able to independently select (reach or point) and play with a variety of toys presented on a table in front of them*

- *Are able to play with at least four toys safely and independently*

Does this sound like your child?

If child appears to meet the criteria for participation, continue with (d) below. If the child does not meet the criteria, say to the parent:

We really appreciate your interest in this study. However, it seems that your child doesn't fit the requirements for participation in the study because ... (age, too few toys of interest, etc.).

- *Offer to provide information about participation in other studies for which the child might eligible,*

d. Description of procedures and duration of participation
This is what we will be doing with children who are able to participate in the study:

- *First, we will ask you some questions about your child's favorite toys*
- *Next, we will consult with your child's teacher to find a time that we can work with her for 10-30 min on 3-5 days per week. Each visit will be enough time for one or two preference assessments, and your child will finish the study in 2-6 visits.*
- *Next, I and the teacher will complete the assent process with your child before our first visit. I will ask if he or she would like to come to an area inside or just outside the classroom to play, and the teacher will observe to see if he or she is willing to go with me. If so, we will start having our scheduled visits.*
- *Next, we will have between two and six visits to conduct preference assessments until we get a successful outcome (i.e., information about at least one toy your child likes a lot and at least one toy that he or she chooses less often).*
- *Information about your child's preferences will be provided to you and to your child's classroom teacher at the end of the study. Both documents will include preference ranks for different toys assessed with your child, your child's name, and the date of his or her successful assessment.*
- *It should take no more than three weeks and a total of three hours away from the classroom to finish this study.*

e. Voluntary participation, risks, and benefits
Your participation in this study is completely voluntary and you can discontinue at any time without penalty. Risks to your child might include injury while playing with the toys that we provide, mild frustration when toys are removed, and loss of up to 30 min of classroom time per session. We'll try to minimize these risks by using safe toys that you recommend, by keeping the sessions brief, and scheduling our sessions around instructional time with input of your child's teacher. If your child does become upset we'll stop the session and try again later. If 2 sessions are discontinued because your child is upset, we will discuss with you your child's further participation in the study. The main benefit of this study for you will be a

better understanding of your child's preferences. Again, you may withdraw at any time without penalty to you or your child.

f. Whom to call with questions
If you have any other questions or concerns, you can also call Dr. Carr at WMU (387-4925).

g. Invitation
Would you be interested in learning more about the study? (If parent indicates yes, send a copy of the consent form home with child, schedule one telephone follow up to answer questions after reviewing the form. If parent declines invitation, thank parent for time and interest). You do not need to make a decision about participating in this study until you have read the consent document and had a chance to ask questions. Once this occurs, you will be asked to sign and return the consent document in your child's backpack or in person at school.

Appendix F

HSIRB Consent Form

EVALUATION OF A PROGRESSIVE MODEL FOR IDENTIFYING PREFERRED STIMULI FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES

WESTERN MICHIGAN UNIVERSTIY

- Department Of Psychology -

Permission of Parent of Guardian

Principal Investigator: James E. Carr, Ph.D.
Co-investigator: Amanda M. Karsten
Student Investigator: Tracy L. Lepper

Your child has been invited to participate in a research project entitled "Evaluation of a Progressive Method for Identifying Preferences of Children with Developmental Disabilities". A preference assessment is a procedure used to determine what toys, foods, or activities a person likes best. In this study, we will be looking at toy preferences using different preference assessment methods. During each assessment, a series of four to seven toys that you recommend will be presented to your child and he or she will have the opportunity to select the one he or she wants to play with the most. If one type of assessment does not work, another type will be attempted until the researchers have identified the toys your child likes best. The purpose of this study is to improve the effectiveness of preference assessments with children diagnosed with developmental disabilities, and to develop a system for teachers and parents to choose the best methods for different children.

Permission for your child to participate in this study means that your child may participate in one session (no more than 30 minutes in length) during the school day to evaluate his or her toy preferences. Two to six sessions over one to three weeks, depending upon your child's school schedule, may be needed to finish the study. All preference assessments last approximately 10-30 minutes, and your child may complete one or two assessments per session. If you allow your child to participate in this study, he or she will go through as many as four types of preference assessments and one reinforcer assessment:

The benefits your child may receive include: (a) a clear ranking of preferred toys for use in other therapeutic programs and (b) the ability to have preferences identified more quickly and accurately in the future. A benefit to you as a parent could be a clearer understanding of your child's preferences. Toy preferences identified in our study will be provided to you and to your child's classroom teacher.

One risk with this study is that your child may be injured while playing with certain toys. To minimize this risk, we will only use safe, age-appropriate toys that you have told us your child can use without supervision. We will also closely monitor your child at all times during sessions to prevent injuries. Another risk associated with this study is that your child may experience some frustration during periods when toys are taken away. To counteract this, sessions will be kept brief (10-30 minutes) and the time spent between opportunities to make a choice (no toys available) will be minimized (0-5 sec). When a longer delay between choice opportunities or assessments is needed, other toys that you recommend will be provided for your child. In the event that your child displays evidence of distress or unwillingness to participate, the session will be terminated. If two sessions in a row are terminated, your child's participation will be reevaluated with the primary investigator's input. Another potential risk is the loss of as many as 30 minutes from the regularly scheduled school activities. To counteract this, the small number of sessions needed to participate in the investigation (2-6) will be scheduled around instructional activities and with teacher input. As in all research, there may be unforeseen risks to your child. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or treatment will be made available to you or your child except as otherwise specified in this permission form.

No videotaping will be used in this study. Your child's name will be omitted from all data collection forms and a code number will be attached, except in the case of the "Preference Summary Form". This document summarizes the most and least preferred items that we identify for your child and his or her name and assessment date will be included on the form. One copy of this form will be sent home in a sealed envelope marked with your name at the conclusion of the study. Your child's classroom teacher will receive another copy of the same form that will be hand-delivered by the researcher. All other forms will include only your child's code number, and the principal investigator will keep a separate master list with the names of the children and the corresponding code numbers. No names will be used if the results are published or reported at a professional meeting. All information will be stored for at least 3 years in locked file cabinets in the Clinical Behavior Research Laboratory (Wood Hall – 1526) or Dr. Carr's office (Wood Hall – 3758) at WMU. Only research staff involved with this project will have access to these videotapes.

At any time you may withdraw your child from this study. Refusal to participate or withdrawal from this study will not result in penalties or repercussions from the professional or school that referred you to the study. If you have any questions or concerns about this study, you may contact the Principal Investigator, Dr. James Carr (269-387-4925), or the Student Investigator, Tracy Lepper (269-387-4629). You may also contact the Human Subjects Institutional Review Board (269-387-8293) or the Vice President for Research (269-387-8298).

This permission document has been approved for use for one year by the Human Subjects Institutional Review Board as indicated by the stamped date and signature of the board chair in the upper right corner. I will not participate in this project if the corner does not have the stamped date and signature.

My signature below indicates that I, as parent or guardian, can and do give permission for

_____ (son/daughter's name) to participate in the previously described investigation.

_____   _____

Parent/Guardian Signature   Date

_____   _____

Permission Obtained By   Date

Appendix G

HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: April 30, 2007

To: Jim Carr, Principal Investigator
         Amanda Karsten, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 07-03-08

This letter will serve as confirmation that your research project entitled "Evaluation of a Progressive Model for Identifying Preferred Stimuli for Children with Developmental Disabilities" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: March 21, 2008

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FOOTNOTE

[1] The distinction between relative and absolute dimensions of reinforcement was discussed at length by Roscoe, Iwata, and Kahng (1999). In sum, absolute reinforcement refers to the amount of behavior a reinforcer produces (i.e., rate of responding) and requires a single-operant method of evaluation. Relative reinforcement is the degree to which one stimulus functions as a more or less effective reinforcer than another stimulus and can be assessed using the concurrent-operant procedures described, herein.