

*EVALUATION OF THE RATE OF PROBLEM BEHAVIOR MAINTAINED
BY DIFFERENT REINFORCERS ACROSS PREFERENCE ASSESSMENTS*

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The rates of problem behavior maintained by different reinforcers were evaluated across 3 preference assessment formats (i.e., paired stimulus, multiple-stimulus without replacement, and free operant). The experimenter administered each assessment format 5 times in a random order for 7 children with developmental disabilities whose problem behavior was maintained by attention, tangible items, or escape. Results demonstrated different effects related to the occurrence of problem behavior, suggesting an interaction between function of problem behavior and assessment format. Implications for practitioners are discussed with respect to assessing preferences of individuals with developmental disabilities who exhibit problem behavior.

Key words: autism, developmental disability, ecological validity, preference assessment, problem behavior

Assessments designed to identify preferred stimuli for use in behavioral assessments and interventions are administered routinely with individuals with developmental disabilities (Hagopian, Long, & Rush, 2004). Multiple preference-assessment formats have been developed and evaluated including (a) single stimulus (e.g., Roscoe, Iwata, & Kahng, 1999); (b) paired stimulus (PS; e.g., Fisher et al., 1992); (c) multiple stimulus (e.g., Windsor, Piché, & Locke, 1994); (d) multiple-stimulus without replacement (MSWO; e.g., DeLeon & Iwata, 1996); (e) single-stimulus engagement (e.g., DeLeon, Iwata, Conners, & Wallace, 1999; Hagopian, Rush, Lewin, & Long, 2001); and (f) free operant

(FO; e.g., Ringdahl, Vollmer, Marcus, & Roane, 1997; Roane, Vollmer, Ringdahl, & Marcus, 1998). Of these six different formats, the literature suggests that the PS, MSWO, and FO formats are perhaps the most commonly used (Hagopian et al., 2004).

For the PS format, the implementer presents two items simultaneously from a pool of items and asks the participant to choose (e.g., Fisher et al., 1992). Following selection, the participant is permitted brief access to the item and then the item is removed. The implementer then presents a new pair of items in the next trial. For the MSWO format, the implementer presents all items within the pool of potential items in an array and asks the participant to choose one (e.g., DeLeon & Iwata, 1996). As in the PS procedure, the participant accesses the chosen item briefly before the implementer removes the item, and a subsequent trial is

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conducted. However, the chosen item is not placed back in the array during subsequent trials. For the FO format, the implementer presents the entire group of items in an array and moves a distance away from the assessment area during the procedure (e.g., Roane et al., 1998). The participant is free to access any item (or no item), and items are not removed from the participant during the assessment.

One important difference among formats involves the removal of an item after the participant has had access to it. In the PS and MSWO formats, the implementer takes the chosen items away from the participant. However, in the FO format, the participant can continue to access all items throughout the assessment. A second difference among formats involves the amount of interaction between the implementer and the participant. In the PS and MSWO formats, the implementer repeatedly interacts verbally and physically with the participant. Specifically, the implementer speaks to the participant (i.e., “choose one”), maintains close proximity, and may deliver physical contact when removing items from the participant’s hands. Conversely, during the FO format, the implementer intentionally maintains a sufficient distance from the participant to avoid interfering with the participant’s behavior. A third procedural difference involves the number of instructions or demands placed on the participant. Specifically, during the PS and MSWO formats, the implementer instructs the participant to choose between items by giving a verbal demand (i.e., “choose one”). However, no verbal demands are delivered during the FO format.

Although many previous studies have compared preference assessment formats in terms of their ability to identify potential reinforcers (e.g., DeLeon & Iwata, 1996; DeLeon et al., 1999, 2001; Kodak, Fisher, Kelley, & Kiszmore, 2009; Worsdell, Iwata, & Wallace, 2002) and the consistency of results both between and within formats over time (e.g., DeLeon et al., 2001; DeLeon & Iwata, 1996; Roane et al., 1998; Windsor et al., 1994), only two previous

studies have compared preference assessment formats in terms of the rates of problem behavior that may occur during implementation (Kang et al., 2010; Roane et al., 1998).

Roane et al. (1998) compared the PS and FO formats in terms of assessment outcome, administration duration, and occurrence of problem behavior. Higher levels of problem behavior occurred during the PS format than during the FO format. Roane et al. suggested that rates of problem behavior varied as a result of an interaction between the procedures used in each assessment format and the function of the participant’s problem behavior. The authors discussed three specific potential interactions. First, if the participant’s problem behavior was maintained by access to attention, the higher rates of problem behavior during the PS format may be explained by the paucity of attention delivered (i.e., that the quality or quantity of attention was insufficient to abate problem behavior). Second, if problem behavior was maintained by access to tangible items, the higher rates during the PS format may be explained by the removal of preferred items from the participant. Finally, if problem behavior was maintained by escape, then perhaps placing a demand on the participant to choose between stimuli may have evoked escape-maintained problem behavior. However, definitive statements regarding these plausible interactions could not be made because the experimenters did not conduct functional analyses of the participants’ problem behavior.

Kang et al. (2010) examined one of the potential interactions between function and format proposed by Roane et al. (1998). Specifically, Kang et al. compared rates of problem behavior across the PS, FO, and MSWO formats after conducting functional analyses of two participants’ problem behavior. Functional analysis results indicated that problem behavior was maintained by access to tangible items. Each assessment format was administered five times, and rates of problem behavior were compared across the assessments. Lower rates of problem behavior occurred during

the FO format than during the PS and MSWO formats. Furthermore, during the PS and MSWO formats, problem behavior occurred when the implementer withdrew an item and not while the participant had free access to items or received demands to choose between items. These results supported the suggestion made by Roane et al., but the analysis did not include problem behavior maintained by other reinforcers (i.e., attention and escape).

The purpose of the current study was to compare the rates of problem behavior maintained by tangible items, attention, and escape during the PS, MSWO, and FO formats. We investigated three hypotheses extended from explanations proposed by Roane et al. (1998). First, we hypothesized that problem behavior maintained by access to tangible items would occur at higher rates during the PS and MSWO formats than during the FO format. Second, problem behavior maintained by attention would be more frequent during the FO format than during the MSWO and PS formats. Finally, we hypothesized that problem behavior maintained by escape would occur at higher rates during the PS and MSWO formats than in the FO format.

METHOD

Participants and Settings

The participants were seven children with developmental disabilities who exhibited problem behavior. Participants were recruited by referrals from teachers due to problem behavior exhibited at school. Sharon was a 4-year-old Asian-American girl who had been diagnosed with developmental delay. Her problem behavior consisted of crying and yelling (i.e., screaming out with a high-pitched voice). Carlos was a 6-year-old Asian-American boy who had been diagnosed with autism. His problem behavior included hand mouthing (i.e., putting his fingers past the plane of his lips) and elopement (i.e., moving at least 0.6 m away from the assessment area). Donovan was a

6-year-old African-American boy who had been diagnosed with autism. His problem behavior was elopement. Neo was an 8-year-old Caucasian boy who had been diagnosed with autism. His problem behavior included making statements unrelated to the current context and putting his head face down on the desk while yelling. An example of Neo's contextually inappropriate speech was telling his teacher, "You wear a tough jacket." In the classroom, this contextually inappropriate speech was of sufficient frequency and volume to be distracting to the teacher and other students and often prevented on-topic conversations and appropriate social interactions. Fred was a 6-year-old African-American boy who had been diagnosed with autism. His problem behavior was elopement. Sarah was a 6-year-old Mexican-American girl who had been diagnosed with autism. Her problem behaviors were crying and elopement. Ellen was a 4-year-old Caucasian girl who had been diagnosed with developmental delay. Her problem behavior was noncompliance (i.e., looking at the ceiling of the classroom and providing no response within 5 s of receiving a demand from a teacher).

All participants were able to scan items in an array, discriminate among items, and indicate preference by reaching towards or naming preferred items. They attended self-contained special education classrooms at private and public schools that served children with developmental disabilities. Functional analyses and preference assessments were conducted in a partitioned section of a separate empty classroom or in a small room attached to the participants' classroom.

Measurement, Reliability, and Procedural Integrity

During the functional analysis, data on problem behavior were recorded using 10-s partial-interval recording and reported as percentage of intervals. During the preference assessments, data on problem behavior were collected using frequency within 10-s intervals. Because different preference assessment formats required

various lengths of time to complete, the total frequency of problem behavior was summed across the observation session and converted to a rate (responses per minute) by dividing the total number of problem behaviors that occurred during the assessment by the duration of the assessment (in minutes). Two observers independently recorded data during 30% of all functional analysis and preference assessment sessions for each participant. For the functional analysis, interobserver agreement was calculated by dividing the number of intervals in which both observers agreed by the total number of intervals (agreements plus disagreements), and multiplying the result by 100%. Mean interobserver agreement for each participant was as follows: Sharon ($M = 100\%$), Carlos ($M = 98\%$; range, 93% to 100%), Donovan ($M = 96\%$; range, 87% to 100%), Neo ($M = 92\%$; range, 90% to 100%), Fred ($M = 98\%$; range, 93% to 100%), Sarah ($M = 100\%$), and Ellen ($M = 95\%$; range, 90% to 100%). For the preference assessment, interobserver agreement for problem behavior was calculated by dividing the lower frequency of the target behavior in each interval by the higher frequency in each interval. These fractions then were summed across all intervals, divided by the total number of intervals in the session, and multiplied by 100%. Mean interobserver agreement for each participant was as follows: Sharon ($M = 97\%$; range, 90% to 100%), Carlos ($M = 98\%$; range, 90% to 100%), Donovan ($M = 95\%$; range, 92% to 97%), Neo ($M = 86\%$; range, 71% to 100%), Fred ($M = 99\%$; range, 93% to 100%), Sarah ($M = 100\%$), and Ellen ($M = 100\%$).

Procedural fidelity data were collected during 30% to 33% of the functional analysis and preference assessment sessions using procedural checklists designed specifically for each functional analysis condition and assessment format. Procedural fidelity was calculated by dividing the number of steps completed accurately by the total number of steps in each condition or format and multiplying the result by 100%. For

the functional analysis, mean procedural fidelity was 99% (range 97% to 100%) and, for the preference assessments, mean procedural fidelity was 100%.

Design

Phases 1 (functional analysis) and 2 (preference assessment comparison) were conducted using multielement designs.

PHASE 1: FUNCTIONAL ANALYSIS

Procedure

Functional analyses of problem behavior were conducted based on the procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). Specific conditions included attention, tangible, escape, and control. Sessions were 5 min, and a minimum of five sessions were conducted in each condition. Functional analyses continued until differential responding emerged. During the attention condition, the implementer instructed the child to play with toys. The implementer sat beside the participant, withheld verbal and physical attention, and pretended to do work (e.g., reading a paper). Contingent on problem behavior, the implementer delivered verbal attention and brief physical contact (e.g., rubbing the participant's back) for 10 s. During the tangible condition, the participant was allowed to access a toy for 10 s. After 10 s, the implementer took the toy and placed it in sight but out of the participant's reach. Contingent on problem behavior, the participant was given access to the toy for 10 s. Toys used were selected based on a paired-stimulus preference assessment conducted prior to the study. During the escape condition, the implementer delivered a demand selected from the participant's individualized education plan and used a least-to-most prompting sequence (i.e., verbal, model, and physical guidance). Contingent on problem behavior, the implementer withdrew the task demand by ceasing the prompting and removing the task materials; in the absence of the problem behavior, the demand was reinstated after a 10-s

break. During the control condition, the implementer interacted with the participant by delivering attention (i.e., praise and physical contact) at least once every 30 s, provided free access to toys, and withheld all demands.

During the functional analysis, if the child engaged in one of the defined topographies of problem behavior, the programmed consequence was delivered immediately. In most instances, target behaviors ceased when consequences were delivered. For example, contingent on Carlos hand mouthing in the tangible condition, the implementer offered Carlos the toy and Carlos removed his hands from his mouth to grasp the item. In cases in which the problem behavior did not cease with the delivery of the tested reinforcer (attention, break from work, or toy), the reinforcer was not withdrawn again until the behavior had ceased for 10 s. The function of Fred's problem behavior was identified via a modified functional analysis (Lalli & Kates, 1998; Lang et al., 2010) because he engaged in problem behavior (i.e., elopement) even when the implementer delivered the programmed consequence. For example, in the tangible condition, Fred eloped even after he received access to the toy and, in the escape condition, he continued to elope after the task demand and materials were removed. Based on observations made during the functional analysis, we hypothesized that elopement was sensitive to attention (e.g., Fred looked over his shoulder as he ran away smiling). Specifically, he may have wanted the implementer to give chase, and thus, the establishing operation (EO) for attention may have been present in all of the test conditions. Therefore, to control for this EO, the implementer delivered attention in the form of eye contact and verbal interaction continuously during all functional analysis conditions except the attention condition.

Results

Figure 1 displays the functional analysis results for each participant. Sharon's problem

behavior occurred almost exclusively in the tangible condition ($M = 58\%$ of intervals; range, 30% to 70%), rarely occurred during the escape ($M = 1.4\%$ of intervals; range, 0% to 7%) and play ($M = 0.6\%$ of intervals; range, 0% to 3%) conditions, and never occurred during the attention condition. These data suggested that Sharon's problem behavior was maintained by access to tangible items. Carlos's problem behavior occurred primarily in the tangible condition ($M = 22\%$ of intervals; range, 3% to 43%), with lower levels occurring in the escape ($M = 4\%$ of intervals; range, 3% to 17%) and attention conditions ($M = 3\%$ of intervals; range, 3% to 13%). No problem behavior occurred during the play condition. Overall, Carlos's results suggested that his problem behavior was maintained by access to tangible items, although responding was less differentiated in the final sessions of the functional analysis. For Donovan, higher levels of problem behavior occurred in the tangible condition ($M = 43\%$ of intervals; range, 20% to 70%) relative to the control (play) condition ($M = 5\%$ of intervals; range, 0% to 27%). Levels of problem behavior in the attention condition ($M = 3\%$ of intervals; range, 0% to 10%) and escape condition ($M = 32\%$ of intervals; range, 3% to 77%) were less differentiated from the control. Therefore, despite the slight increase during the escape condition toward the end of assessment, Donovan's data suggested a tangible function for problem behavior.

Neo's highest levels of problem behavior relative to the control condition occurred during the attention condition ($M = 46\%$ of intervals; range, 37% to 63%), with lower levels of problem behavior during the tangible ($M = 16\%$ of intervals; range, 5% to 28%), escape ($M = 8\%$ of intervals; range, 5% to 12%), and play ($M = 15\%$ of intervals; range, 5% to 22%) conditions. These results suggested that Neo's problem behavior was maintained by attention. The results of the modified functional analysis for Fred showed the highest levels of problem

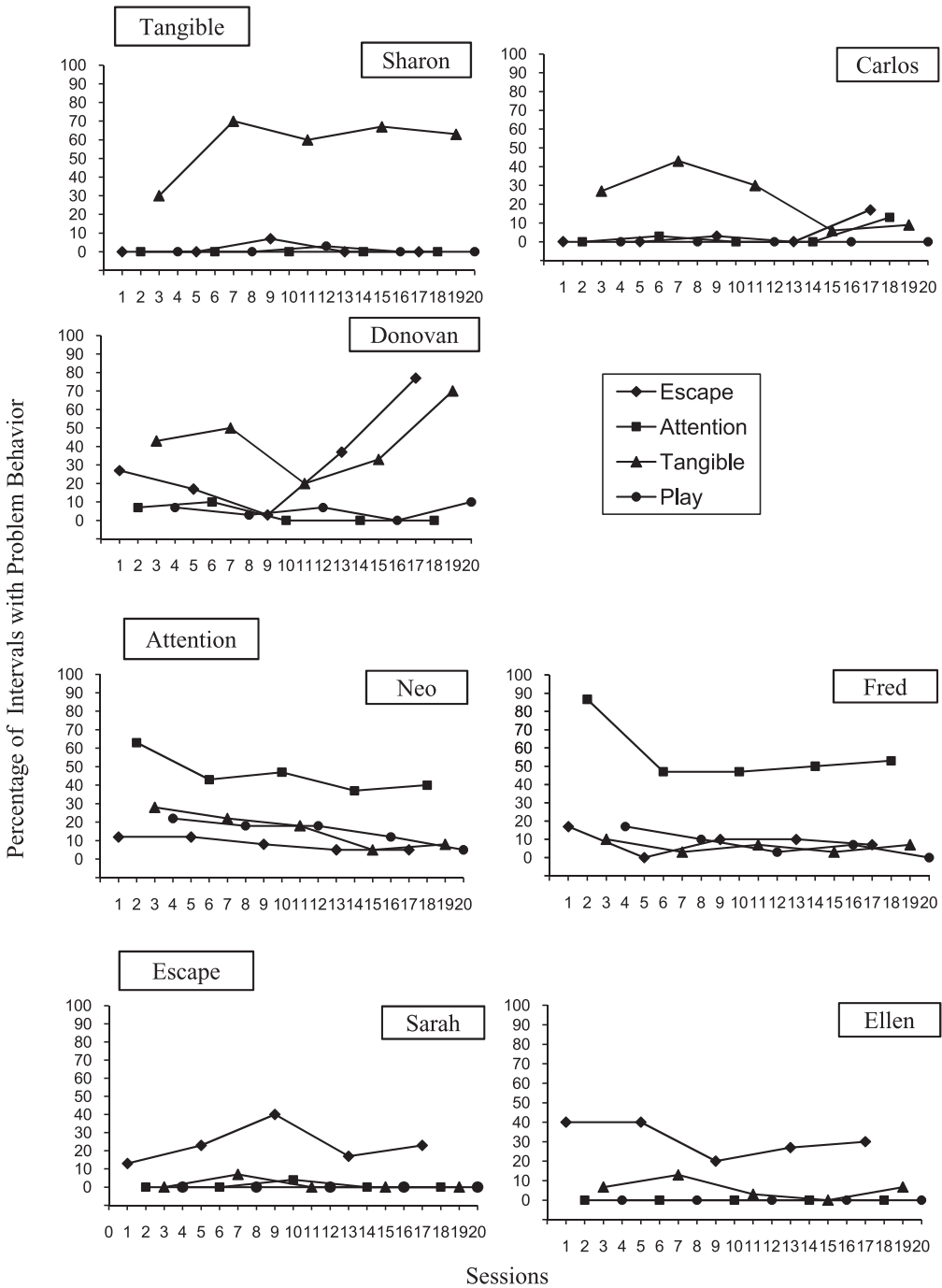


Figure 1. Results of the functional analysis across participants.

behavior during the attention condition ($M = 57\%$ of intervals; range, 47% to 87%), with lower levels of problem behavior during the tangible ($M = 6\%$ of intervals; range, 3% to 10%), escape ($M = 9\%$ of intervals; range, 0% to 17%), and play ($M = 7\%$ of intervals; range, 0% to 17%) conditions. These data suggested that Fred's problem behavior was sensitive to attention.

Sarah's problem behavior occurred primarily in the escape condition ($M = 23\%$ of intervals; range, 13% to 40%) and only rarely in the attention ($M = 1\%$ of intervals; range, 0% to 4%) and tangible ($M = 1\%$ of intervals; range, 0% to 7%) conditions. No problem behavior was observed in the play condition. These data suggested that Sarah's problem behavior was maintained by escape. Ellen's problem behavior occurred primarily in the escape condition ($M = 31\%$ of intervals; range, 20% to 40%), with lower levels of problem behavior in the tangible condition ($M = 6\%$ of intervals; range, 3% to 13%), and no problem behavior in the attention or play conditions. These data suggested that Ellen's problem behavior was maintained by escape.

PHASE 2: PREFERENCE ASSESSMENT

Procedure

Each preference assessment format was administered five times in a random order, for a total of 15 assessments for each participant. Six items were used in the preference assessments. The participants' teachers identified the items as potential reinforcers. The items remained constant throughout the study for each participant. The duration of each assessment averaged 25 min for PS, 3 min for MSWO, and 5 min for FO.

Paired-stimulus procedure. The PS format was conducted in a manner similar to that described by Fisher et al. (1992). Two items were presented approximately 0.7 m apart on the table, and the participant was instructed to choose one item. If the participant touched or named an item, he or she was allowed to interact with it for 20 s. If the participant did

not select either item within 5 s, the implementer removed them and presented the next pair. The presentation order of item pairs was determined randomly, with the exception that the same pair was not presented on consecutive trials. A minor modification to the PS procedure described by Fisher et al. was made as an additional control for the potential of the items' position in the pair (left or right) to bias the participant's selection (e.g., a participant might always choose the item on the right). To control for this potential position bias, each item pair was presented twice (as opposed to once in the Fisher et al. study) in a counterbalanced way so that each item in the pair appeared on both sides.

Multiple-stimulus without replacement procedure. The MSWO format was implemented as described by DeLeon et al. (2001). All six items were presented to the participant in a straight line on a table approximately 5 cm apart. The participant sat approximately 0.3 m from the array and was instructed to choose one item. After selecting an item, the participant had access to it for 20 s. After 20 s, the item was removed and never presented again during the session. Before the next trial, items were rearranged to reduce the effects of a potential position bias. The assessment continued until all items had been selected and removed, or until the participant had not selected an item within 30 s.

Free-operant procedure. The FO format was implemented as described by Roane et al. (1998). All six items were placed approximately 5 cm apart in a straight line on a table. The participant sat approximately 0.3 m from the item array and was free to access any item, multiple items, or none at all. No item was withdrawn, and no demands were given. The session lasted 5 min and began when the implementer left the assessment area (i.e., moved at least 2 m away).

Results

Figure 2 presents the rates of problem behavior for each participant across the three preference assessments. The first three panels display the data for the participants whose problem behavior was

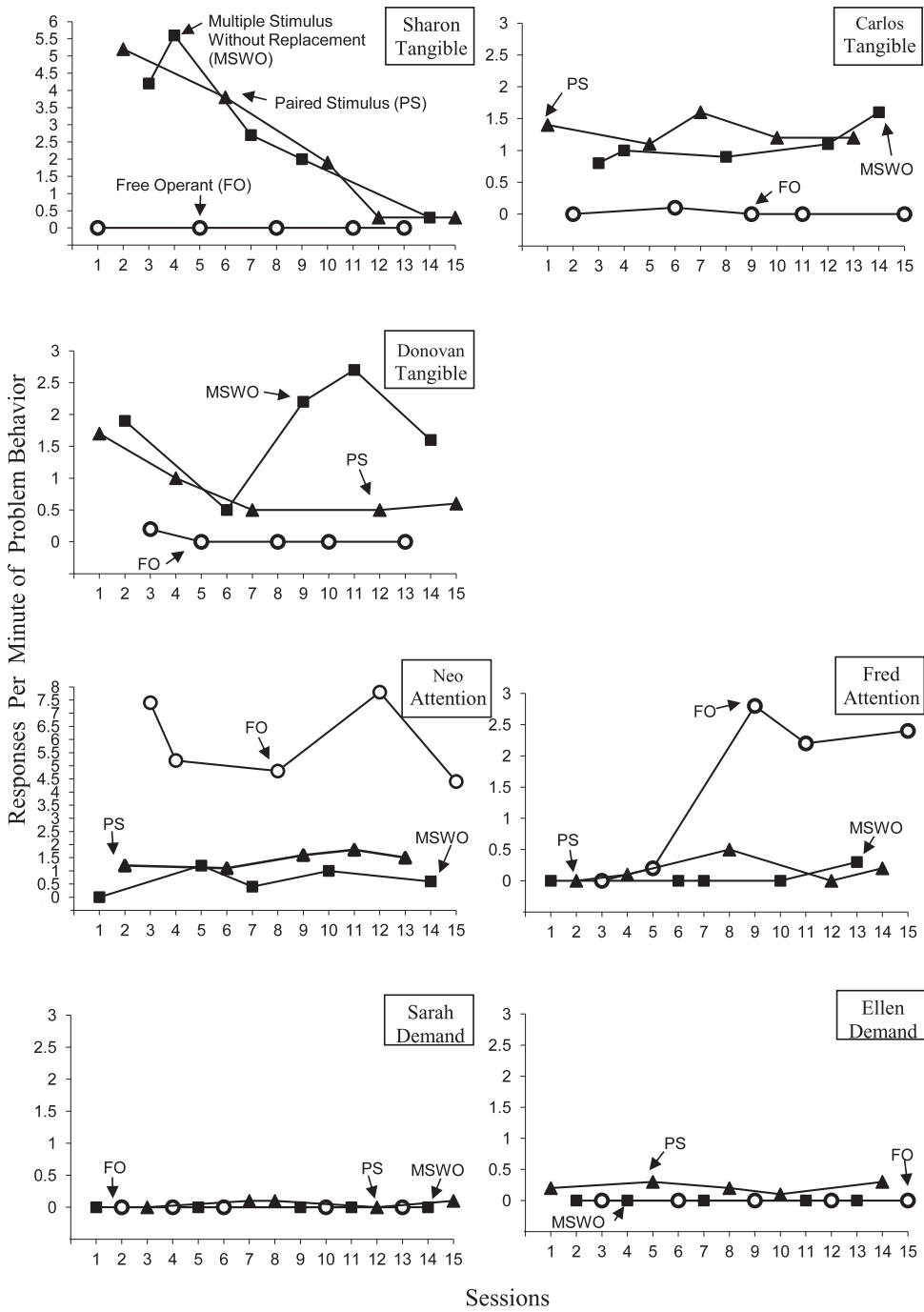


Figure 2. Rate of problem behavior during the paired stimulus (PS), multiple-stimulus without replacement (MSWO), and free-operant (FO) preference assessments.

maintained by tangible items (Sharon, Carlos, and Donovan). The middle panels display the data for the participants whose problem behavior was maintained by attention (Neo and Fred). The bottom panel displays the data for participants whose problem behavior was maintained by escape (Sarah and Ellen).

Problem behavior maintained by access to tangible items. Sharon exhibited high rates of problem behavior during the PS ($M = 2.3$ responses per minute; range, 0.3 to 5.2) and MSWO ($M = 1.1$ responses per minute; range, 0.3 to 5.6) formats. Levels of problem behavior were on a decreasing trend in both formats. Sharon exhibited no problem behavior during the FO format. Carlos exhibited similarly high rates of problem behavior during the PS ($M = 1.3$ responses per minute; range, 1.1 to 1.6) and MSWO ($M = 1.1$ responses per minute; range, 0.8 to 1.6) formats. During the FO format, rates of problem behavior were near zero ($M = 0$ responses per minute; range, 0 to 0.1). Donovan's problem behavior also occurred most often during the PS ($M = 1.0$ responses per minute; range, 0.5 to 1.7) and MSWO ($M = 1.8$ responses per minute; range, 0.5 to 2.7) formats, with near zero problem behavior during the FO format ($M = 0$ responses per minute; range, 0 to 0.2).

Problem behavior maintained by attention. Neo exhibited the highest rates of problem behavior during the FO format ($M = 6.0$ responses per minute; range, 4.4 to 7.8), with lower levels during the PS ($M = 1.4$ responses per minute; range, 1.1 to 1.8) and MSWO ($M = 0.6$ responses per minute; range, 0 to 1.2) formats. Fred also exhibited high rates of problem behavior during the FO format ($M = 1.5$ responses per minute; range, 0 to 1.8), and very low rates were observed during the PS ($M = 0.2$ responses per minute; range, 0 to 0.5) and MSWO ($M = 0.1$ responses per minute; range, 0 to 0.3) formats.

Problem behavior maintained by escape. Sarah's rates of problem behavior were at or near zero during all formats (PS; $M = 0.06$ responses per

minute; range, 0 to 0.1). Similar to Sarah, Ellen exhibited no problem behavior during MSWO and FO and near zero during PS ($M = 0.2$ responses per minute; range, 0.1 to 0.3).

All preference assessments had been videotaped (with the exception of those for Sharon), which permitted us to conduct a within-session analysis to determine when problem behavior occurred during each assessment format. Observers recorded problem behaviors that occurred immediately after (a) the implementer delivered a demand (i.e., "choose one"), (b) the participant had access to the items but no interaction with the implementer, or (c) the implementer withdrew an item from the participant. The frequency of problem behavior occurring following (a), (b), or (c) was collected and converted to a percentage of the total problem behavior that occurred during the entire session by dividing the frequency of problem behavior occurring in either (a), (b), or (c) and dividing by the total frequency of problem behavior. The percentages of problem behavior in (a), (b), and (c) then were compared for each participant. Figure 3 displays the results for all participants except Sharon.

Recall that Carlos's and Donovan's problem behavior was maintained by access to tangible items. Carlos exhibited 80% of his problem behaviors after the withdrawal of an item. Another 10% occurred when he had access to items but no implementer attention, and 10% occurred when the implementer asked him to choose between items. Donovan exhibited 84% of his problem behaviors following the withdrawal of an item. Nine percent occurred when he had access to items but no attention, and 7% occurred when the implementer asked him to choose between items.

Recall that Neo's and Fred's behavior was maintained by attention. Neo exhibited 88% of his problem behavior when he had access to items but no attention. Six percent occurred when the implementer withdrew the item, and 5% when the implementer asked him to choose.

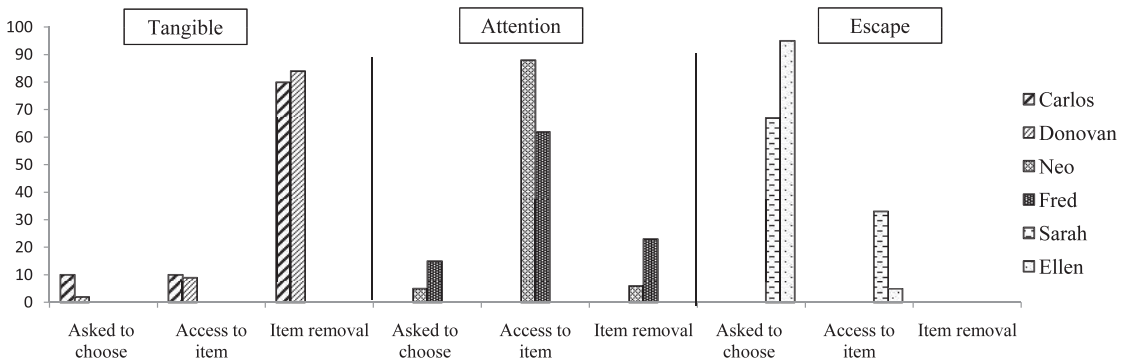


Figure 3. Results of the within-session analysis across behavioral functions.

Fred exhibited 62% of his problem behavior when he had access to items but no attention. Another 23% of his problem behavior occurred when the implementer withdrew the item, and the final 15% occurred when the implementer presented the choice.

Recall that Sarah's and Ellen's behavior was maintained by escape. Sarah and Ellen never displayed problem behavior during the MSWO and FO formats. They exhibited very low rates of problem behavior during the PS format. Sarah exhibited 67% of her problem behavior (three occurrences) when the implementer asked her to choose during the PS format. She exhibited 33% (one occurrence) of her problem behavior when she had access to items but no attention. No problem behavior occurred when the implementer withdrew an item. Ellen exhibited 95% of her problem behavior when the implementer asked her to choose during the PS format. She exhibited 5% of her problem behavior when she had access to items but no attention. No problem behavior occurred when the implementer withdrew an item.

DISCUSSION

The present study examined the interaction between the function of problem behavior and the occurrence of problem behavior across different preference assessment formats. Results indicated that problem behavior was more

probable when the assessment procedures involved either the removal of items (PS and MSWO) from participants whose problem behavior was maintained by access to tangible items or reduced interaction between the implementer and participant (FO) for participants whose problem behavior was maintained by attention. These results were supported by the within-session analysis that indicated a temporal relation between problem behavior and the procedural step that matched the evocative event associated with the function of the problem behavior (e.g., the removal of an item preceded problem behavior maintained by access to tangible items). Together, these findings replicated the preliminary results of Kang *et al.* (2010) and provided empirical support for the broader suggestion of Roane *et al.* (1998), with the exception of the results for escape-maintained problem behavior (as described further below).

Possible explanations for these findings are as follows. First, the PS and MSWO formats required items to be withdrawn repetitively. Thus, participants whose problem behavior was maintained by access to tangible items may have been more likely to engage in problem behavior during these assessments because, in the past, the behavior produced continued access to the items. Second, the FO format involved less interaction between the implementer and the participant than the other formats. Thus,

participants whose problem behavior was maintained by attention may have been more likely to engage in problem behavior because it typically produced attention from others.

The third hypothesis examined in this study was not supported. Specifically, the delivery of demands for participants whose problem behavior was maintained by escape did not result in high rates of problem behavior. Problem behavior occurred at very low rates in the PS format and never occurred in the MSWO or FO formats. One potential explanation is that the type of demand delivered during the preference assessments (i.e., choose a toy) was not sufficiently aversive to evoke escape-maintained behavior. This explanation seems plausible when this type of demand is compared to those delivered in the functional analysis (skills not yet mastered from the participant's educational, vocational, or habilitation program). Furthermore, Lalli et al. (1999) demonstrated that reinforcement of compliance was an effective intervention for escape-maintained problem behavior. The PS format essentially replicated the experimental arrangement described by Lalli et al.; the participant was asked to complete a task (i.e., make a choice), and compliance resulted in access to a relatively preferred item.

These results have several implications for practitioners. The outcomes of preference assessments may be questionable if problem behavior impedes the accurate or complete implementation of the assessment. Therefore, it may be beneficial to consider the function of problem behavior when selecting the specific assessment format to be used with an individual who engages in problem behavior. For example, the PS and MSWO formats contain more interactions between the implementer and participant and may, therefore, be preferable for individuals whose problem behavior is maintained by attention. Similarly, individuals who engage in problem behavior maintained by tangible positive reinforcement may do best

with the FO format, which does not require the withdrawal of tangible items.

Nonetheless, other factors should be considered when selecting a preference assessment format, including the availability of resources (Hagopian et al., 2004), the duration of administration time (DeLeon & Iwata, 1996; Roane et al., 1998), and the need to identify multiple potential reinforcers (DeLeon et al., 2001). For example, the FO format yields limited information regarding relative preferences (DeLeon et al., 1999; Worsdell et al., 2002), so this format may be contraindicated if a hierarchy of preferred stimuli is a desired outcome of the assessment. In such cases, formats that produce a ranking of preferred items could be modified to reduce the likelihood of problem behavior related to tangible items. For example, during the PS format, the implementer could show the individual the next pair of items prior to the removal of the item most recently selected. This approach might reduce the EO related to item removal. Alternatively, it may be beneficial to limit the number of items assessed so as to reduce the number of withdrawals required or split the assessment into small clusters of presentations. For the MSWO format, the participant could be allowed to access the selected item for a longer period of time, which might temporarily reduce the reinforcing value of the item and decrease the likelihood of problem behavior when the item is withdrawn. The PS and MSWO formats also could be modified if the quantity or quality of attention involved in the procedures are not sufficient to attenuate attention-maintained problem behavior. Dense schedules of noncontingent physical and verbal attention may be beneficial during the item-access period.

Additional modifications to the preference assessment formats may be necessary for individuals whose problem behavior is maintained by both attention and tangible items. For example, the FO format combined with a dense

schedule of noncontingent attention may be appropriate. Alternatively, the implementer could modify the MSWO format by delivering noncontingent attention, providing longer access to selected items, and redirecting the participant's attention to the remaining items when the chosen item is withdrawn.

Additional research is needed to examine the effectiveness of these suggested formats and modifications. Future research also might evaluate whether data on problem behavior exhibited during various assessment formats are helpful for generating preliminary hypotheses about the function of problem behavior. Finally, we did not examine how problem behavior affected the individuals' choice outcomes. Thus, further research in this area might examine how often participants fail to select or engage with items during trials with problem behavior compared to trials without problem behavior and whether items identified as most preferred during a preference assessment with problem behavior are effective as reinforcers.

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