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Evaluation of the Rate of Challenging Behavior Maintained by Different Reinforcers Across Three Preference Assessments

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Evaluation of the Rate of Challenging Behavior Maintained by Different Reinforcers Across Three Preference Assessments

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Dedication

For the Lord, my God and children with special needs who God loves

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Abstract

Preference is commonly incorporated into educational interventions for individuals with developmental disabilities. Preference assessments have a solid research base indicating that they are more reliable tools for finding preference than the subjective opinions of parents and teachers. As evidence-based practices have been emphasized, the preference assessment has been a regular component of interventions and instructional programs for the population. Along with the utility, research regarding the assessment and relevant variables has also increased. However, many questions still exist and wait for more inquiry.

One of the practical issues is the occurrence of challenging behaviors of individuals with disabilities during preference assessments. Highly occurring challenging behavior during an assessment may interrupt the procedure and lead to inaccurate results

about the individual's preference. That may ultimately affect the effectiveness of the intervention or instructional program. Using a procedure that does not evoke challenging behavior is necessary for accurate results as well as ethically responsible. Therefore this study examined the relation between functions of challenging behavior and three commonly used preference assessment procedures: Paired-Stimulus (PS), Multiple-Stimulus without Replacement (MSWO), and Free-Operant (FO).

This study had two phases: Functional analyses and preference assessments. First, functional analyses were conducted to identify the function of challenging behaviors. The participants were nine children with developmental disabilities whose functional analysis results indicated their challenging behavior was maintained by access to tangible items (5), attention (2), and escape (2) reinforcers. After identifying the behaviors' functions, preference assessments were implemented to compare the rates of the challenging behaviors. Each preference assessment format was conducted 5 times, in a random order for each participant. The results of the study demonstrate that the occurrence of challenging behavior with different functions was different depending on procedure formats. This suggests that there would be a relation between functions of challenging behavior and preference assessment formats. In other words, depending on the function of challenging behavior, the assessment procedure may act as a trigger evoking the challenging behavior. This study discussed practical guidance to prevent challenging behavior during preference assessments.

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CHAPTER 1

INTRODUCTION

Preferences of children with developmental disabilities can be utilized in diverse manners during educational intervention. For example, preferred activities or objects may be embedded in an instructional activity (e.g., Foster-Johnson, Ferro, & Dunlap, 1994; Kogel, Dyer, & Bell, 1987); used to provide opportunities for choice (e.g., Cole & Levinson, 2002; Seybert, Dunlap, & Ferro, 1996); employed as non-contingent reinforcers (e.g., Hagopian, Bruzek, Bowman, & Jennett, 2007); and employed contingently as reinforcers for desired behavior (e.g., Lalli & Kates, 1998). Previous research has demonstrated that integrating preference into educational activities or intervention strategies is effective in promoting desired responses and achieving positive outcomes. Therefore, it is essential to identify preferred stimuli and the assessment to identify children's preferences has been a regular component of the intervention process for children with developmental disabilities. (Fisher, Piazza, Bowman, Hagopian et al., 1992; Romaniuk & Miltenberger, 2001).

The challenge of identifying the preferences of children with developmental disabilities is that they typically have language delay or impairment that interrupts to express what they want (Ivancic & Bailey, 1996; Reis, Everson, & Green, 1999). Rough estimates of preferences may result in ineffective intervention outcomes. Dyer (1987) made a comparison of the reinforcing effect on changing behavior between stimuli that have been systematically assessed via a preference assessment and typical stimuli not

selected via the assessment. The results revealed that the systematically assessed stimulus had an influence on increasing targeted responses and reducing inappropriate behavior, while the typical stimulus did not. Even though parents' and teachers' guesses may narrow the range of children's preferences, their subjective opinions often result in inaccurate predictions about a reinforcing effect (Cote, Thompson, Hanley, & McKerchar, 2007; Fisher, Piazza, Bowman, & Amari, 1996; Green, Reid, Canipe, & Gardner, 1991). Therefore it has been emphasized that preferences of children with disabilities must be determined on the basis of empirical evidence drawn from a systematic assessment procedure. (Fisher, Piazza, Hagopian, Bowman, & Toole, 1996). In addition Individuals with Disabilities Education Act (IDEA 2004) mandates that teachers implement research-based practices. Therefore teachers need to find students' preferred items that serve as reinforcers through a preference assessment.

Preference assessment on the basis of direct observation has evolved in methodologies to systematically investigate more accurate and differentiated preferred stimuli. Hagopian, Long, and Rush (2004) categorized the preference assessment procedure using direct observation as two formats based on choice response measures: approach-based and engagement-based procedures. The approach-based procedure determines preference based on the children's touching one of the presented stimuli during the assessment. Depending on the manner in which the stimuli are presented, the approach-based procedure is divided into: (a) single-stimulus (SS; e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985; Roscoe, Iwata, & Kahng, 1999); (b) paired-stimulus (PS;

e.g., Dattilo, 1986; Mason, McGee, Farmer-Dougan, & Risley, 1989; Fisher, Piazza, Bowman, Hagopian et al., 1992); (c) multiple-stimulus (MS; e.g., Windsor, Piché, & Locke, 1994); and (d) MS without replacement (MSWO; e.g., DeLeon & Iwata, 1996). In each trial, a single stimulus is presented in the SS procedure, and a stimulus pair is presented in the PS procedure. All stimuli are presented as an array in each trial in the MS procedure. If the participant chooses a stimulus it is used again in the next trial. Perishable food items are replaced with fresh identical items. The MSWO procedure is conducted in the same manner as the MS procedure, but the chosen stimulus is not replaced and, therefore, not available in the next trial. These approach-based procedures yield preference outcomes based on the number of each stimulus chosen, or the proportion of trials in which the stimulus is chosen to the total trials.

Engagement-based procedure determines preference based on the duration of the child's engagement in the chosen stimuli during the assessment. Engagement-based procedure involves: (a) single-stimulus engagement (SSE; e.g., DeLeon, Iwata, Conners, & Wallace, 1999; Hagopian, Rush, Lewin, & Long, 2001) and (b) free-operant (FO; e.g., Ringdahl, Vollmer, Marcus & Roane, 1997; Roane, Vollmer, Ringdahl, & Marcus, 1998). In the SSE procedure, each individual stimulus is presented for a limited time (e.g., 2 minutes), while the entire group of stimuli is presented as an array in the FO procedure, as in the MS and MSWO procedures. In the FO procedure, the participant can freely access the array and manipulate any stimulus, multiple items, or none at all. No stimuli are removed. The SSE and FO procedures yield preference outcomes based on the

proportion of engagement time with each stimulus to the total/limited period.

Previous research has evaluated the various preference assessment formats in order to identify reliable methods for determining preference that can serve as effective reinforcers. Some studies examined single preference assessment procedures with some variations such as different types of stimuli (e.g., Higbee, Carr, & Harrison, 1999; Horrocks & Higbee, 2008), presence and absence of actual stimuli (e.g., Kuhn, Deleon, Terlonge, & Goysovich, 2006), and duration of stimulus availability (e.g., Steinhilber & Johnson, 2007). Other studies assessed the efficacy of different formats in identifying preference to be effective reinforcers (e.g., DeLeon & Iwata, 1996; Roane et al., 1998; Rosco et al., 1999). Several studies compared outcomes of the different formats based on several major dimensions such as correspondence and consistency of choice responses (e.g., DeLeon & Iwata, 1996; Roane et al. 1998; Winsor et al., 1994).

Although such research endeavors have expanded the knowledge base of preference assessment procedures, researchers have suggested more in-depth investigation, including examination for specific variables, such as identification of the procedure best matched to an individual with particular characteristics (Cannella, O'Reilly, & Lancioni, 2005; Hagopian et al., 2004). Specific characteristics of children with developmental disabilities have been cited as one of the variables to be considered when selecting a preference assessment. For instance, Deleon et al. (1999) suggested that the SSE preference assessment might be a more appropriate format for individuals who have difficulty making a selection among multiple stimuli. Because of the diversity of

characteristics of children with developmental disabilities, more examination of preference assessment procedures for each characteristic is suggested.

Children with developmental disabilities, because of their limited communication abilities and adaptive behavioral repertoires, are more likely to engage in challenging behavior to communicate their needs (Sigafoos, Arthur, & O'Reilly, 2003). Challenging behavior is defined as any behavior that is "destructive, harmful, disruptive or otherwise unacceptable and that occurs with sufficient frequency and/or severity to be of major concern" (Sigafoos et al., 2003, p.7). A major assumption regarding challenging behavior in the behavior analytic approach is that the behavior has a function or purpose. There are four functions which are access to tangible items, getting attention, escape from a task, and sensory. When challenging behavior has an access to tangible item function children engage in their challenging behaviors in order to access their preferred items or activities. Applying a similar rationale, when challenging behavior has a getting attention function, children engage in their challenging behaviors to get attention from others. Otherwise, when challenging behavior has an escape function, children engage in their challenging behaviors to escape from a task or demand. In some cases children engage in their challenging behavior, such as rocking or spinning to get sensory reinforcement that the behavior itself generates. The function of the rocking or spinning behavior is to get sensory reinforcement.

Roane, Vollmer, Ringdahl, and Marcus (1998) compared the PS and FO formats in terms of assessment outcome, administration duration, and occurrence of challenging

behavior. Regarding the occurrence of challenging behavior, higher levels occurred during the PS format than during the FO format. As a plausible explanation for these results, Roane et al. (1998) suggested that rates of challenging behavior may vary as a result of an interaction between the unique procedures used in each preference assessment format and the function of the participant's challenging behavior. The results imply that an assessment procedure may act as a trigger evoking the challenging behavior depending on the function of challenging behavior. Highly occurring challenging behavior during an assessment may interrupt the assessment. That can lead to inaccurate results about the children's preference. That may ultimately affect effectiveness of the intervention or instructional program. Moreover, if an assessment is highly likely to evoke challenging behaviors, stakeholders such as parents and teachers may decide that it is not acceptable for their children. Therefore if possible it is necessary to use the procedure that does not evoke challenging behavior not only for accurate results but it is also ethically responsible.

The purpose of the current study is to examine the relation between functions of challenging behavior and preference assessment procedures. For this the study investigates three hypotheses by comparing the rates of challenging behavior maintained by a function (e.g., access to tangible items, getting attention, or escape) during the PS, MSWO, and FO formats. The three formats are commonly used in practice. However these formats differently present three conditions that may evoke challenging behaviors. Those conditions are removing chosen items, the extent to which the implementer

interacts with the child, and demanding a choice. The first condition that may evoke challenging behaviors is removing chosen items. 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. Therefore the first hypothesis is that challenging behavior maintained by access to tangible items would occur at higher rates during PS and MSWO formats in which tangible items are withdrawn relative to the FO format in which tangible items are not withdrawn.

The second condition that may trigger challenging behaviors is the amount of interaction between the implementer and the participant. In the PS and MSWO formats the implementer repeatedly verbally and physically interacts with the participant. Specifically, the implementer speaks to the participant (i.e., “chose 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 in an effort to avoid interfering with the participant’s behavior. Therefore the second hypothesis is that challenging behavior maintained by attention should be more frequent during the FO format in which fewer interactions between the implementer and participant occur relative to MSWO and PS formats in which physical and verbal attention are delivered during each trial.

The third condition is the number of instructional demands placed upon 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., “chose one”).

However, during the FO format no verbal instructions are provided. Therefore the last hypothesis is that challenging behavior maintained by escape would occur at higher rates during the PS and MSWO formats in which instructional demands are provided relative to the FO format in which instructional demands are not given.

In summary this study examines if challenging behavior with a function may occur more, in the format where the related trigger condition is present than where it is absent. This study addresses a common practical issue that teachers can meet but that is often overlooked. The study can give practical guidance to prevent or reduce the occurrence of challenging behavior during preference assessments. As a result, the study can contribute to obtain accurate preference results, and ultimately lead to positive effectiveness of the intervention.

CHAPTER 2

EMPIRICAL REVIEW OF COMPARISONS OF DIFFERENT PREFERENCE ASSESSMENT PROCEDURES

Preference assessments have a solid research base supporting their use and are now routinely used when developing interventions for individuals with developmental disabilities (Hagopian, Long, & Rush, 2004). Earlier research demonstrated that the indirect method, based on the opinion of major caregivers, often produced inconsistent results and inaccurate predictions about the influence of the preference, compared with the direct assessment which is based on a direct and systematic procedure. Therefore diverse direct preference assessment methods have been developed to identify more accurate and differentiated preferred stimuli that may have effective reinforcing value. These formats include SS, PS, MS, MSWO, SSE and FO.

Along these lines, several researchers evaluated the different procedures and results to the relative efficacy or reliability (e.g., correspondence and consistency) for finding exact preference (e.g., DeLeon et al., 2001; Hagopian, Rush, Lewin, & Long, 2001; Kodak, Fisher, Kelley, & Kisamore, 2009; Roane, Vollmer, Ringdahl, & Marcus, 1998; Winsor, Piché, & Locke, 1994; Worsdell, Iwata, & Wallace, 2002). Even though such research endeavors have expanded the knowledge of preference assessment procedures, to date, a review of the literature on the evaluation of comparison between different preference assessment procedures has not emerged. Therefore the purpose of this chapter is to review the literature with respect to relative efficiency and reliability in

identification of preference. In addition, other factors that have been compared in the literature are reviewed. This review may provide a blueprint for further investigation in the area.

Methods

Studies meeting the following three criteria were included in this review. The study (a) compared different preference assessment procedures to identify participants' preference through experimental study based on direct observation, (b) was conducted with participants with developmental disabilities, and (c) was published in peer-reviewed journals between 1985 and 2010. The year 1985 was chosen as the starting point because systematic examination of preference and its effectiveness via empirical experiments did not begin in earnest until the mid-1980s (e.g., Pace, et al., 1985).

The literature search was conducted through EBSCO, an electronic journals service, using five relevant databases, ERIC, PsychINFO, MEDLINE, PsycARTICLES, and Psychology and Behavioral Sciences Collection. The keywords used in the electronic search were "preference assessment", "stimulus preference", "preferred stimulus", or "comparison preference assessments" and "developmental disability". The database search retrieved 206 studies. In addition to the electronic search, reference chasing was carried out in pre-selected or relevant studies. Fifteen studies (n=100 participants) were selected based on the above inclusion criteria.

The selected studies were sorted into three categories according to major elements evaluated in comparison of the efficacy of the preference assessment procedures. The

three categories were (a) predictive validity for reinforcing effectiveness, (b) correspondence among different procedures, and (c) consistency across repeated administrations of the same procedure. The category of prediction validity for reinforcing effectiveness includes studies in which the relative reinforcing effects of preferred stimulus, identified from each preference assessment, were examined via a reinforcement assessment. On the basis of the comparison, the results indicated which preference assessment procedure more accurately predicted stimuli with effective reinforcing power. The category of correspondence among different procedures involves studies that evaluate, as an indicator of reliability, the level of consistency of results achieved among different procedures. The category of consistency across repeated administrations of the same procedure includes studies that compare, as a distinct indicator of reliability, the stability of results across multiple administrations in each procedure.

Table 1 describes the listed studies based on the following six variables: (a) the number of participants, (b) the type of disability, (c) the number and type of stimuli, (d) the average duration of administration, (e) compared procedures, and (f) results. The results were reported with respect to each of the three categories. In the results of the first category listed in Table 1, the "<" or ">" symbols indicate that the procedures placed at the open end of the symbol have more predictive validity for reinforcing effectiveness of the stimuli. The "="symbol indicates that both procedures show similar predictive validity. For example, PS > SS signifies that the PS procedure produces a more accurate prediction for reinforcing effectiveness. In the results of the second category in the table,

mixed result means that the preference results are similar among some higher preferred stimuli, but not others, or for some participants, but not others. In addition, correlation coefficient values provided in the table are mean values.

The remainder of the chapter provides results, discussion and future research. The results report findings of the relevant studies according to the aforementioned three categories. Two sample studies in each category clearly delineate methods of comparison and outcomes. The overall efficacy of preference assessment procedures, other examined factors, and future research are discussed.

Table 1: Studies listed according to categories of comparing the efficacy of preference assessments

Categories/ Studies	*n*	Type of Disability	Number & Type of Stimuli	Duration	Compared Procedures	Results
I. Predictive validity for reinforcer effectiveness						
*DeLeon, Fisher, Rodriguez-Catter, Maglieri, Herman, & Marhefka (2001)	5	MR + severe behavior disorders/ PDD/ Prader-Willi syndrome	7 to 9 food & nonfood stimuli	PS: No information Brief MSWO: 1-2 min	Extensive PS / Daily MSWO	Extensive PS < brief MSWO
**DeLeon & Iwata (1996)	7	Profound developmental disabilities	7 leisure & edible stimuli	MS: M=16.5min PS: M=53.3min MSWO: M=21.8min	PS / MSWO / MS	PS=MSWO >MS
DeLeon, Iwata, Conners, & Wallace (1999)	4	MR	7 nonfood stimuli	MSWO: No information SSE=14 min	MSWO / SSE	MSWO < SSE
*Erbas, Ozen, & Acar (2004)	3	Down syndrome	10 leisure & edible stimuli	No information	PS / SS	PS > SS
*Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin (1992)	4	MR + Seizure/ PDD/ Down syndrome	16 food & nonfood stimuli	No information	PS / SS	PS > SS

Table 1, cont.

Categories/ Studies	*n*	Type of Disability	Number & Type of Stimuli	Duration	Compared Procedures	Results
Kodak, Fisher, Kelly, & Kisamore (2009)	4	Developmental disabilities/ Autism	6 food & leisure items	MSWO: No information FO: 5 min	MSWO/FO	MSWO > FO
* Lanner, Nichols, Field, Hanson, & Zane (2009)	4	Autism/MR	5 edible & tangible items	PS: M=7.5 min MSWO: M=10 min	PS / MSWO	PS=MSWO
Ortiz & Carr (2000)	3	MR	7 to 8 toys	MSWO: No information FO: 5 min	MSWO/FO	MSWO = FO
*Paclawskyj & Vollmer (1995)	4	MR + Visually impaired	6 edible, social, tactile, & auditory stimuli	No information	PS / SS	PS > SS
Rosco, Iwata, & Kahng (1999)	8	MR	10 food stimuli	No information	PS / SS	PS=SS
Worsdell, Iwata, & Wallace (2002)	4	MR	7 tasks	SS: 35 min FO: 5 min	SS / FO	SS > FO

Table 1, cont.

Categories/ Studies	*n*	Type of Disability	Number & Type of Stimuli	Duration	Compared Procedures	Results
II. Correspondence among procedures						
*DeLeon, Fisher, Rodriguez-Catter, Maglieri, Herman, & Marhefka (2001)	5	MR + severe behavior disorders/ PDD/ Prader-Willi syndrome	7-9 food & nonfood stimuli	PS: No information Brief MSWO: 1-2 min	Extensive PS / Daily brief MSWO	No correspondence
**DeLeon & Iwata (1996)	7	Profound developmental disabilities	7 leisure & edible stimuli	MS: M=16.5min PS: M=53.3 min MSWO: M=21.8 min	PS / MSWO / MS	PS / MSWO (τ =.72) showed higher correspondence than PS / MS (τ =.61)
* Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin (1992)	4	MR+ Seizure/ PDD/ Down syndrome	16 food & nonfood stimuli	No information	PS / SS	Mixed results - The most preferred item was matched but not other items.
**Hagopian, Rush, Lewin, & Long (2001)	4	MR + Autism + severe behavior challengings	8 to 13 food & nonfood stimuli	PS: Mean range 49- 69 min SSE: Mean range 36- 63 min	PS / SSE	Mixed results - Results for two participants showed high correspondence (*r*=.78, *r*=.61) but not for two (*r*=.04, *r*=.13).
* Lanner, Nichols, Field, Hanson, & Zane (2009)	4	Autism/MR	5 edible & tangible items	PS: M=7.5 min MSWO: M=10 min	PS / MSWO	Mixed results The most and least preferred items were matched but no other items.

Table 1, cont.

Categories/ Studies	*n*	Type of Disability	Number & Type of Stimuli	Duration	Compared Procedures	Results
* Paclawskyj & Vollmer (1995)	4	MR + Visually impaired	6 edible, social, tactile, & auditory stimuli	No information	PS / SS	Mixed results The most preferred item was matched but no other items.
Roane,Vollmer, Ringdahl, & Marcus, (1998)	20	Severe developmental disabilities	10-11 food, drinks, leisure, play, tactile, auditory stimuli, and social attention	PS: M=21.67 min FO: M= 5 min	PS / FO	Mixed results The most preferred item was matched for 8 of the 17 participants but not others.
Thomson, Czarnecki, Martin, Yu, & Martin (2007)	15	Profound developmental disabilities	6 food and 6 nonfood stimuli	No information	PS / SS	Moderate to high correspondence (r=.58 to r=.61)
* Windsor, Piché, & Locke (1994)	8	MR + Cerebral palsy/ Rhetts syndrome	6 foods & drinks	MS: M=7 min PS: M=16 min	PS / MS	Mixed results The most preferred item was matched for 6 of the 8 participants but not others. - Overall results for 5 of the 8 participants showed correspondence. (τ =.75)

Table 1, cont.

Categories/ Studies	*n*	Type of Disability	Number & Type of Stimuli	Duration	Compared Procedures	Results
III. Consistency across administrations						
**DeLeon & Iwata (1996)	7	Profound developmental disabilities	7 leisure & edible stimuli	MS: M=16.5 min PS: M=53.3 min MSWO: M=21.8 min	PS / MSWO / MS	- Both PS (*w* =.83) and MSWO (*w* =.81) showed moderate to high consistency. - MS showed low consistency (*w* =.57).
**Hagopian, Rush, Lewin, & Long (2001)	4	MR + Autism + severe behavior challengings	8 to 13 food & nonfood stimuli	PS: Mean range 49- 69 min SSE: Mean range 36- 63min	PS / SSE	PS produced more consistency than SSE
* Windsor, Piché, & Locke (1994)	8	MR + Cerebral palsy/ Rhetts syndrome	6 foods & drinks	PS: M=16 min (10-22min) MS: M=7 min (3-10 min)	PS / MS	PS (*w*=.63) produced more consistency than MS (*w*=.49)

Note. One asterisk (*) indicates that the study is included in two categories and two asterisks (**) indicate that the study is included in three categories of the table.
MR = Mental Retardation; PDD = Pervasive Developmental Disorder; PS = Paired-Stimulus procedure; MSWO = Multiple-Stimulus Without Replacement procedure; MS = Multiple-Stimulus procedure; SSE = Single Stimulus Engagement procedure; FO = Free-Operant procedure; SS = Single-Stimulus procedure.

Results

Predictive Validity for Reinforcing Effectiveness

Twelve of 15 studies examined efficacy of preference assessment procedures in relation to accurate prediction for stimuli with effective reinforcing power to change the targeted behavior. Four of the 12 studies compared efficacy of the PS and SS procedures via a reinforcement assessment that examined reinforcing effects (Erbas, Ozen, & Acar, 2004; Fisher, Piazza, Bowman, Hagopian et al., 1992; Paclawskyj & Vollmer, 1995; Rosco et al., 1999). Three studies compared the PS and MSWO procedures (DeLeon et al., 2001; DeLeon & Iwata, 1996; Lanner, Nichols, Field, Hanson, & Zane, 2009). Two studies compared the MSWO and FO procedures (Kodak, Fisher, Kelly, & Kisamore, 2009; Ortiz & Carr, 2000). The following pair procedures were compared in four studies: the MSWO and MS (DeLeon & Iwata, 1996), the MSWO and SSE (DeLeon et al., 1999), the PS and SSE (Hagopian et al., 2001), and the SS and FO procedures (Worsdell, Iwata, & Wallace, 2002). Most studies (i.e., eight of the twelve) compared the PS procedure with other procedures, followed by the MSWO and SS procedures respectively.

The results of the studies in this category revealed that the PS procedure produced more accurate predictions for stimuli with reinforcing power than the SS or MS procedures. However, compared to the MSWO, the PS procedure resulted in similar (DeLeon & Iwata, 1996; Lanner, Nichols, Field, Hanson, & Zane, 2009) or less accurate predictions than the MSWO (DeLeon et al., 2001). The MSWO procedure produced similar or more accurate predictions than the FO (Kodak, Fisher, Kelly, & Kisamore, 2009; Ortiz & Carr, 2000). On the other hand, the MSWO procedure yielded less

accurate predictions than the SSE (DeLeon et al., 1999). The SSE and PS procedures yielded similar accuracy of prediction (Hagopian et al., 2001). The SS procedure proved more accurate than the FO procedure but less accurate than the PS procedure. However, most examined preference assessments accurately identified the most preferred stimuli with the most effective reinforcing power.

For example, Fisher, Piazza, Bowman, Hagopian et al. (1992) compared the efficacy of the PS and SS procedures for four participants with developmental disabilities. The studies were conducted in two phases: a preference assessment and a reinforcement assessment. In the preference assessment phase, the hierarchy of preferred stimuli was identified via each PS and SS procedure. In the reinforcement assessment phase, the relative reinforcing effects of the identified preference results were compared by "a concurrent-operants paradigm" in the following manner (Roane et al., 1998, p. 610). The identified preference results were divided into two types of stimulus groups (i.e., high-high and SP-high). The high-high stimulus group involved stimuli commonly identified as highly preferred for both the PS and SS procedures. The SP-high stimulus group involved stimuli identified as highly preferred for the SS procedure but not the PS. The two types of stimuli were placed in two adjacent squares or chairs concurrently. If the participants moved toward one of the squares/chairs (i.e., engaging in the targeted behavior) they could obtain the stimulus as a consequence. The group of stimuli more frequently accessed by participants was measured and compared. The results revealed that high-high stimuli demonstrated more reinforcing power than SP-high stimuli. In other words, the PS procedure predicted more accurately than the SS procedure which

stimuli had reinforcing power. The study concluded that both the PS and SS procedures could identify the most preferred stimuli, but the PS procedure had better predictive validity of reinforcing effects for the lower preferred stimuli, as well as the higher preferred ones.

Deleon and Iwata (1996) emphasized the necessity of advanced preference assessment and suggested the MSWO procedure as one of the assessments to compensate for the disadvantages of the PS and MS procedures. They examined the efficacy of the MSWO procedure by comparing it with the MS and PS procedures for seven participants with profound developmental disabilities. The comparison of the three procedures was accomplished by measuring reinforcing effects of the stimuli, identified as preferred via the MSWO and PS procedures, but not selected in the MS procedure. Specifically, the preferred stimuli identified via the MSWO and PS procedures, but not selected in the MS procedure, were delivered as reinforcers in a fixed-ratio schedule when the participants engaged in the targeted behavior (i.e., depositing game pieces into a Connect Four game). As a result, the stimuli used as reinforcers caused different levels of the targeted behavior: the stimuli derived from the MSWO and PS procedures produced higher levels of the targeted behavior than the stimulus derived from the MS procedure. This result indicated that the MSWO and PS procedures produced more predictive validity for reinforcers than the MS procedure. In addition, the study advocated that the MSWO procedure would create more reliable results than the MS procedure and take less administration time than the PS procedure.

Correspondence Among Procedures

As mentioned in the previous chapter, preference assessment procedures relying on direct observation methods are classified in two categories, approach-based or engagement-based. The SS, PS, MS, and MSWO procedures were included in the approach-based assessment that measured choice responses of participants by touching the stimuli, and the measuring dimension of the dependent variable was the percentage of trials chosen. Conversely, the FO and SSE procedures were included in an engagement-based assessment that measured choice responses based on duration of engagement/play with the chosen stimuli, and the measuring dimension was the percentage of intervals of stimulus engagement. The studies in this category analyzed correspondence among results based on the percentage alone (e.g., Fisher, Piazza, Bowman, Hagopian et al., 1992) or the ranking order indicated by the percentages (e.g., DeLeon & Iwata, 1996; Hagopian et al., 2001). In addition, the results for correspondence were analyzed descriptively based on these percentages or ranking orders (i.e., DeLeon et al., 2001; Fisher, Piazza, Bowman, Hagopian et al., 1992; Paclawskyj & Vollmer, 1995; Roane et al., 1998) or analyzed via statistical analysis methods with the percentage or ranking data: Kendall rank-order correlation coefficients (i.e., DeLeon & Iwata, 1996; Windsor et al., 1994); Spearman rank-order correlation coefficients (i.e., Hagopian et al., 2001); or Pearson product-moment correlation coefficients (i.e., Thomson et al., 2007).

Nine studies examined whether preference results obtained in this manner from the different preference assessment procedures were consistent. Three of the nine studies assessed the results from the PS and SS procedures (i.e., Fisher et al., 1992; Paclawskyj

& Vollmer, 1995; Thomson et al., 2007). The results of these studies showed that only the most preferred stimuli were consistent, and most of the lower preferred stimuli were not. Three of the nine studies evaluated results from the PS and MSWO procedures (i.e., DeLeon et al., 2001; DeLeon & Iwata, 1996; Lanner, Nichols, Field, Hanson, & Zane, 2009). One of the three studies revealed relatively high correspondence (τ =.72) between the two procedures (DeLeon & Iwata, 1996), whereas the other studies revealed no correspondence (DeLeon et al., 2001) or mixed results in which the most and least preferred items were matched, but no other items (Lanner, Nichols, Field, Hanson, & Zane, 2009). Additionally, two studies compared the results from the PS and MS procedures (i.e., DeLeon & Iwata, 1996; Windsor et al., 1994). The results revealed that there was moderate (τ =.61) to high correspondence (τ =.75 for 5 of the 8 participants) between the two procedures. One study compared the results from the PS and FO procedures (Roane et al., 1998). The results were mixed. The most preferred items were consistent for eight of the 17 participants but not the rest. Another study compared the results from the PS and SSE procedures (Hagopian et al., 2001). The results also demonstrated mixed results; two of the four participants showed high correspondence (*r*=.78, *r*=.61) but two did not (*r*=.04, *r*=.13). In summary, with regard to correspondence of preference results, most of the studies examined diverse pairs of different procedures and showed mixed results for correspondence or no correspondence between the compared procedures. However the results of the most preferred stimuli from these studies demonstrated relatively high consistency across different procedures.

For example, Roane et al. (1998) compared the PS and FO procedures for 17 participants with moderate to profound mental retardation. They compared the two procedures based on different choice response measures. Specifically, hierarchy preference results were based on the percentage of trials chosen for the PS, an approach-based procedure, and the percentage of intervals of stimulus engagement for the FO, an engagement-based procedure. The percentage of trials chosen for the PS was calculated by dividing the number of times the item was chosen by the number of times the item was presented, and multiplying by 100%. The percentage of intervals of stimulus engagement for the FO was calculated by dividing the number of intervals of item engagement by the total number of intervals of the session, and multiplying by 100%. The researchers descriptively analyzed correspondence between the percentages obtained from the two procedures. The results were mixed, with the most preferred item being consistent for 47.1% of the participants, but were not consistent for 52.9% of the participants (i.e., 9 of 17).

Windsor et al. (1994) compared the PS and MS procedures for eight participants with severe-profound developmental disabilities. They yielded preference-ranking data based on the total percentage of each stimulus chosen by each participant. The correspondence between the ranking data was analyzed via a statistical analysis method, using Kendall rank-order correlation coefficients. The results showed that the preference ranking orders from each PS and MS procedure were moderately correlated (mean τ =.75). Overall preferred results for five of the eight participants were consistent. Specifically, the most preferred items were the same for both procedures for most

participants (i.e., 6 of the 8). Even though the MS and PS procedures identified the same items as most preferred, Windsor et al. revealed that the MS procedure provided the unaltered intensities of the most preferred items (i.e., high selection frequency) whereas the PS procedure provided relatively subdued intensity (i.e., lower or closer selection frequency) of the same most preferred items than the MS procedure.

Consistency Across Administrations

Three studies examined consistency of results across repeated administrations for each procedure. All three analyzed the results using statistical analysis with the ranking order measured by the percentages: Kendall rank-order correlation coefficients and Spearman rank-order correlation coefficients. One study evaluated the consistency of each PS, MS, and MSWO procedure result (DeLeon & Iwata, 1996). The results revealed that both the PS and MSWO procedures produced relatively high consistency (PS: mean *w*=.83; MSWO: mean *w*=.81) whereas the MS procedure produced less consistency (mean *w*=.57) than the others. Another study also assessed the consistency of each PS and MS procedure result (Windsor et al., 1994). Correspondingly, the PS procedure (mean *w*=.63) generated more consistent results than the MS procedure (mean *w*=.49). The remaining study assessed the consistency of each PS and SSE procedure result (Hagopian et al., 2001). Similarly, the study showed that the PS procedure produced more consistent results than the SSE procedure. In summary, with respect to consistency of preference results, all three studies indicated that the PS and MSWO procedures generated similar levels of consistency, and generated higher consistency than the MS and SSE procedures.

For example, Deleon and Iwata evaluated consistency of rankings for three procedures (i.e., PS, MS, and MSWO) using Kendall rank-order correlation coefficients. As a result, both the coefficients from the PS and MSWO procedures demonstrated statistically significant high correlation across repeated administrations (five times) for all seven participants (PS: mean *w*=.83; MSWO: mean *w*=.81). On the other hand, the coefficients from the MS procedure exhibited moderate correlation for five of the seven participants (mean *w*=.57). The coefficients for the other two participants were not statistically significant, that is, there was no correlation across repeated administrations of the MS procedure for the two participants. The results of this study indicated that the PS and MSWO procedures created more stable results across repeated administrations than the MS procedure.

Hagopian et al. (2001) assessed consistency of rankings for the PS and SSE procedures using Spearman rank-order correlation coefficients. The researchers conducted the PS and SSE procedures three times for all four participants. Consistency of rankings using the correlation coefficients was yielded by comparing the first administration with the average of all three administrations, or comparing the average of the first and second administrations with the average of all three administrations for each participant. As a result, the PS procedure produced statistically significant high consistency for three of the four participants, both between the first administration and the average of all three administrations, and between the average of first and second administrations and the average of all three administrations for each participant. The SSE procedure produced statistically significant high consistency for one of the four

participants between the first administration and the average of all three administrations, and between the average of first and second administrations and the average of all three administrations. Consequently, the results indicated that the PS procedure generated more consistent results than the SSE procedure.

Discussion

Efficacy of Preference Assessment Procedures

Previous research has compared the efficacy of preference assessment procedures in terms of predictive validity for reinforcing effectiveness, correspondence among different procedures, and consistency across repeated administrations of the same procedure. The major finding of this research is that the PS and MSWO, approach-based procedures and the SSE, an engagement-based procedure, produced relatively more accurate predictions for stimuli with reinforcing power than other procedures. The results support that the PS, MSWO, and SSE procedures are relatively valid in identifying stimuli with reinforcing value. However, additional research must be conducted for the SSE procedure because the results were derived from only two studies (DeLeon et al., 1999; Hagopian et al., 2001) whereas results for the PS were derived from eight studies and the MSWO from six studies.

One study reported that the PS procedure produced less accurate predictions than the MSWO procedure (DeLeon et al., 1999). However, the study compared reinforcing effects between the results from the PS procedure implemented once at the beginning of the study with results from the brief MSWO procedure implemented daily. According to DeLeon et al. (1999), the less accurate prediction of the PS procedure seems to be caused

by the preference change over time, not by the PS procedure itself. Previous researchers have theorized the possibility of preference change over time (Fisher, Thompson, Piazza, Crosland, & Gotjen, 1997; Roane et al., 1998). They hypothesize that changed preference for a stimulus may alter its reinforcing value and affect the level of targeted response. Due to preference change over time, the early-identified preferred stimulus has often failed to demonstrate the same level of reinforcing effect achieved initially. Consequently, the PS procedure conducted initially seemed to less accurately predict the stimulus with reinforcing power. The results imply that the time factor may be a variable with potential influence on preference assessment results.

On the other hand, the SS procedure displayed less reliable results about the predictive validity. In one study (Rosco et al., 1999) the SS accurately predicted stimuli with reinforcing power, as did the PS procedure. In other studies, however, the SS procedure also proved less accurate than the PS procedure (Erbas et al., 2004; Fisher et al., 1992; Paclawskyj & Vollmer, 1995). The results indicated that the SS does not yield solid evidence of their ability in identifying stimuli with reinforcing value. The FO showed mixed results and the MS lacked evidence of predictive validity for stimuli with reinforcing effectiveness. Moreover, results for the MS procedure require further investigation, as it was derived from a single study (DeLeon & Iwata, 1996; Worsdell et al., 2002).

Another major finding is that most of the procedures examined in the studies reviewed accurately identified the most preferred stimuli with strong reinforcing effectiveness. Therefore, the choice range of the preference assessment may vary,

depending on the number of potential reinforcers the intervention must identify. In other words, if the intervention must employ two or more reinforcers, the results recommend the PS, MSWO, or SSE procedures. However, if only one reinforcer, the most preferred stimulus, is sufficient for the intervention, options for preference assessments are broader, and include the FO or SS procedures. It should be noted that the preference assessment procedure used must be the one determined to be optimally suited to the diverse particular needs of the participant and/or the intervention (Rosco et al., 1999). The number of potential reinforcers may reflect one of the diverse particular needs. Therefore, in order to select the procedure used, it is important to consider the number of potential reinforcers to be used in the intervention.

Some studies evaluated the consistency of results in the different procedures devised to measure preference. The significant finding is that most of the reviewed studies showed mixed results, indicating that preference results are consistent on higher preferred stimuli but not lower, or for some participants, but not others. The mixed results may be, in part, explained by inconsistency produced due to comparison between differentiated preference results yielded from a procedure (e.g., the PS or MSWO procedures) and undifferentiated preference results yielded from a procedure (e.g., the SS, SSE or FO procedures).

Differentiated preference results indicate a clear hierarchy of the examined preferred stimuli. Undifferentiated results demonstrate an unclear or no hierarchy of all stimuli examined, or all but one or two. The PS procedure is usually called a forced-choice procedure in which the participant is asked to select a stimulus from the presented

pair, even though his/her preferred stimulus is not available in the array. Compelling the participant to select a relatively less preferred stimulus available at this juncture can generate more differentiated preference results (Windsor et al., 1994).

On the other hand, the SS/SSE and FO procedures usually produce undifferentiated results with different tendencies. Specifically, the SS or SSE procedures obtained fewer hierarchy preference results because participants are likely to approach most or all of the stimuli presented in the procedures (e.g., Rosco et al., 1999). Similarly, the FO procedure produced undifferentiated results, in which there were exclusively one or two highly preferred stimuli among those presented (e.g., Roane et al., 1998) and the other items were not selected. In other words, selection of a relatively lower preferred stimulus rarely occurred in the FO procedure, thus creating undifferentiated results. These two different tendencies of undifferentiated results may be due to fact that participants have either a very large or very limited number of preferred stimuli (DeLeon et al., 1999).

Rosco et al. (1999) suggested that the undifferentiated results of preference assessments might be influenced by the procedure of the preference assessment. Therefore, it may be difficult to obtain high correspondence of all stimuli based on comparisons among different preference assessment procedures. However, the results of the most preferred stimulus were correspondent among most of the examined procedures. The results indicate that most of the examined preference assessments commonly identify the most preferred stimulus.

Reliability of an assessment procedure was also evaluated by examining the consistency of results of repeated administrations of the same procedure. Some studies compared consistency of preference results obtained from repeated administrations in each assessment. One significant finding is that the PS and MSWO procedures generated consistent results across administrations, while the MS and SSE procedures generated less consistency in their results. This suggests that the PS and MSWO procedures may be relatively stable preference assessments with respect to identifying preferred stimuli. However, only three studies examined consistency across administrations. Therefore, further investigation regarding consistency of results is needed for more diverse preference assessments.

The results regarding the three aspects (i.e., predictive validity, correspondence, and consistency) may lead to some tentative conclusions about efficacy of preference assessment procedures. First, most of the preference assessments in the reviewed studies accurately identified the most preferred stimulus with an effective reinforcing effect. Second, both PS and MSWO procedures may be the more accurate and reliable of the preference assessment procedures examined, followed by the SSE. The SSE procedure yielded accurate predictions of potential reinforcers, but produced less stable preference results. It needs to be noted that one disadvantage of the PS procedure is that it takes longer to implement than other procedures (see Table 1). The long duration of implementation was reported in the most recent studies conducting this procedure (e.g., Hagopian et al., 2001; Roane et al. 1998; Windsor et al., 1994). Therefore, if an intervention assumes a brief preference assessment before implementation, this procedure

may not be appropriate. On the other hand the MSWO needs a relatively very short time of implementation. In this respect the MSWO is more efficient in identifying preference than the PS.

Association Between Preference Assessment Procedures and Challenging Behavior

Researchers have suggested further examination for a preference assessment procedure tailored to the particular characteristics of the individual with developmental disabilities (e.g., Cannella, et al., 2005). One of the studies reviewed measured challenging behaviors of participants during different preference assessments (Roane et al., 1998). Many children with disabilities often engage in their challenging behavior. Therefore challenging behavior may be considered as one of the particular characteristics when implementing a preference assessment (Hagopian, et al., 2004). Their results revealed that 11 of 17 participants showed more inappropriate behaviors in the PS than in the FO procedure. They suggested that there was an association between the functions of challenging behavior and the procedure processing method. Therefore, as a plausible explanation for more occurrences of inappropriate behaviors in the PS procedure, they discussed the relevance between their participants' possible functions (i.e., access to tangible items, getting attention, and escape from a task) and the trigger trait of the PS procedure.

For example, the PS procedure withdraws items from the participants. Therefore, individuals who have tangibly maintained challenging behaviors may exhibit their challenging behaviors in attempting to access the withdrawn items. But such presentation does not occur in the FO procedure. Consequently, there may be fewer or even no

occurrence of the challenging behavior. Thus the FO procedure may work well with individuals with challenging behavior maintained by access to tangible items. Roane et al. suggested that the operant mechanism of challenging behavior could interact with a particular procedure mode, resulting in different occurrences of challenging behavior across assessment procedures. However no study has examined such a hypothesis, and it would need to be supported with more empirical evidence.

This chapter reviewed 15 studies that examined the effectiveness of different preference assessment procedures in light of predictive validity, correspondence, and consistency. In summary, most of the preference assessments in the reviewed studies accurately identified the most preferred stimulus with effective reinforcing power. This review also suggests that, generally, the PS and MSWO procedure may be a relatively accurate and reliable preference assessment. When considering time of implementation, the MSWO may be a more efficient procedure than the PS. However, these results can be considered only provisional because 15 studies were reviewed. Thus it may be too early to conclude which preference assessment is more exact, stable, and efficient. Additionally, when selecting the preference assessment employed in an intervention, it is essential to determine the assessment that will optimally fit the multiple particular needs of the participant and intervention (e.g., preventing challenging behavior).

Future Research

Some suggestions for future research have emerged from this review. First, more supporting evidence must be accumulated regarding diverse preference assessment procedures. According to this review, most examinations for preference assessment

procedures have leaned toward the PS and MSWO procedures. The efficiency of other procedures still remains questionable due to limited evidence. Therefore, more studies of other procedures, such as the FO or SSE, must be conducted. In addition, future research might examine some modification for the preference assessment procedures to complement their drawbacks. Those endeavors may contribute to the development of more advanced assessment procedures.

Second, a specific preference assessment may or may not be a more appropriate format for individuals with a particular characteristic(s). The individual characteristics of children with developmental disabilities are diverse. Thus, diverse preference assessment procedures must be examined to find the optimal fit. A few such endeavors were discussed in this review. Roane et al. revealed different occurrences of challenging behaviors across different procedures. They suggested that a specific function of challenging behavior contributes to the different occurrence of the behavior in a particular procedure mode. However, they did not examine their hypothesis empirically. No study in this review empirically examined the relationship between specific functions of challenging behavior (e.g., tangible, attention, and escape) and the particular procedure modes of preference assessments. Furthermore, if higher rates of challenging behavior occur in a particular procedure in relation to a function, such a conflict may influence preference assessment results needed to effectively serve in the intervention. Therefore, further investigations need to examine the association between the different preference assessment procedures and the functions of the challenging behavior.

The purpose of the current study was to compare the occurrence of challenging behavior maintained by tangible items, attention, and escape during the PS, MSWO, and FO formats. Three hypotheses were investigated. First, challenging behavior maintained by access to tangibles occurs at higher rates during the format in which the implementer withdraws chosen items from the child (i.e., PS and MSWO) than the one in which the implementer does not withdraw any item (i.e., FO). Second, challenging behavior maintained by attention occurs at higher rates during the format in which there are few interactions, resulting in deprivation of attention from the implementer (i.e., FO) than the one in which there is no deprivation of attention (i.e., PS and MSWO). Finally, challenging behavior maintained by escape occurs at higher rates during the format that incorporates more instructional demands (i.e., PS and MSWO) than the one that does not (i.e., FO). In addition, this study analyzed in depth the within-session results of the preference assessments to examine rates of challenging behavior in the presence and absence of a particular trigger condition that might evoke the challenging behavior. In other words, the incidence of challenging behavior would be higher when the condition is present and lower when the condition is absent within each assessment.

CHAPTER 3

METHODS

The purpose of this chapter is to delineate the methods utilized in the study. In the first section, the participant characteristics are described in detail. The second section presents settings and materials used, and the third section provides definitions of variables. In the fourth section, methods for data collection and calculation of interobserver agreement and procedure fidelity are provided. The fifth section describes the procedures of the two phases of this study - functional analyses and preference assessments. Finally, the experimental design is explained.

Participants

Participants in the study were nine children with developmental disabilities who exhibited challenging behaviors. The age range of the participants was 4 to 8 years. Six of the nine children were boys and three were girls. Table 2 summarizes the characteristics of the participants including age in years, gender, ethnicity, disability diagnosis, and function of challenging behavior. Initially, participants were recruited by referrals from their teachers or administrators because of challenging behavior exhibited in school. The function of each participant's challenging behavior was identified via analogue functional analyses (Iwata, Dorsey, Slifer, Bauman, & Richman, 1994).

Britton was a 6-year-old Caucasian male diagnosed with autism. His challenging behavior was throwing objects. Carlos was a 6-year-old Asian-American male diagnosed with autism. His challenging behaviors included hand-mouthing and elopement. Donovan was a 6-year-old African-American male diagnosed with autism. His challenging

behavior also was elopement. Sharon was a 4-year-old Asian-American female diagnosed with developmental delay. Her challenging behavior was crying and/or yelling. Mason was a 6-year-old Caucasian male diagnosed with autism, moderate intellectual disability, Chiara malformation type I, and hypothyroidism. His challenging behavior was pinching, scratching, biting, and crying. Neo was an 8-year-old Caucasian male diagnosed with autism. His challenging behaviors included contextually inappropriate speech or 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" when the teacher was wearing a short sleeve shirt. 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 male diagnosed with autism. His challenging behavior was elopement. Sarah was a 6-year-old Mexican-American female diagnosed with autism. Her challenging behaviors were crying and elopement. Ellen was a 4-year-old Caucasian female diagnosed with developmental delay. Her challenging behavior was non-compliance with instructional demands.

The participants possessed all the skills needed to complete the preference assessments, such as visually scanning, discriminating items, and reaching towards or naming preferred items. They attended self-contained special education classrooms at private and public schools serving children with developmental disabilities.

Table 2: Participant information including age reported in years, gender, ethnicity, disability diagnosis and function of challenging behavior.

Participant	Age	Gender	Ethnicity	Diagnosis	Function
Britton	6	Male	Caucasian	Autism	Tangible
Carlos	6	Male	Asian-American	Autism	Tangible
Donovan	6	Male	African-American	Autism	Tangible
Sharon	4	Female	Asian-American	Developmental Delay	Tangible
Mason	6	Male	Caucasian	Autism, Intellectual Disability, Chiara malformation type I, Hypothyroidism	Tangible
Neo	8	Male	Caucasian	Autism	Attention
Fred	6	Male	African-American	Autism	Attention
Sarah	6	Female	Mexican- American	Autism	Escape
Ellen	4	Female	Caucasian	Developmental Delay	Escape

Settings and Materials

This study had two phases, functional analyses (FA) and preference assessments. All sessions of FA and preference assessments were conducted in separate empty classrooms at the participants' schools. These rooms were rearranged by removing irrelevant toys and materials before the sessions. For the FA phase of the study, materials related to each assessment condition were used, for example, the most preferred item for

tangible condition, a task material for the escape condition, or several toys for the play condition of the FA. For the preference assessment phase of the study, the six items used in the assessments were initially selected based on teachers' reports of participant preferences. There were no changes in the inventory of examined items for each participant during the different preference assessments.

Dependent Variables

In both FA and preference assessment phases, a dependent variable was challenging behavior in each participant. The challenging behavior of each participant was selected by means of an unstructured interview with the participant's teacher and verified with direct observation during classroom activities at school. The operational definition of challenging behavior of each participant is provided in Table 3.

Table 3: The operational definitions of challenging behavior of each participant

Participant	Challenging Behavior
Britton	Throwing objects: forcefully launching an item at least five inches away from his body
Carlos	Hand-mouthing : putting his fingers past the plane of his lips
	Elopement : moving a minimum of 2 feet away from the assessment area
Donovan	Elopement : moving a minimum of 2 feet away from the assessment area
Sharon	Crying: any nonverbal vocalization
	Yelling: screaming out with a high pitched voice
Mason	Pinching: grasping the skin of the experimenter with fingers with any amount of force
	Scratching: nails forcefully sliding across the experimenter's skin
	Biting: teeth making contact with the skin of the experimenter
	Crying: any nonverbal vocalization accompanied by tilting the head backwards beyond a typical degree.
Neo	Inappropriate speech: making statements to the implementer unrelated to his current context (e.g.,"You wear a tough jacket" when the teacher is wearing a short sleeve shirt)
	Head down: putting his head face down on the desk more than 5-s
	Yelling: screaming out with a high pitched voice
Fred	Elopement: moving a minimum of 2 feet away from the assessment area
Sarah	Crying: any nonverbal vocalization
	Elopement: moving a minimum of 2 feet away from the assessment area
Ellen	Non-compliance: looking at the ceiling of the classroom and providing no response within 5-s of receiving an instructional demand from a teacher

Measurement

Data Collection

During the FA phase, challenging behaviors were recorded by the occurrence of the behaviors using 10-second partial interval recording under each of the experimental conditions (i.e., attention, tangible, escape, and play) for each participant. The FA was conducted and coded by the author and trained doctoral students. Some sessions of this phase were videotaped for measuring reliability and fidelity.

During the preference assessment phase, data on challenging behavior was collected using a frequency count which was then converted to the rate of challenging behavior per minute by dividing the total number of challenging behaviors by the number of minutes required to complete the preference assessment (Kennedy, 2005). This conversion from frequency to rate was done in order to allow comparisons between different preference assessment formats that required varying amounts of time to complete. The author, as the primary coder, recorded frequency of challenging behavior based on observation of the videotapes.

Inter-observer Agreement

Two doctoral students served as secondary observers. Secondary coders independently recorded 30% of all sessions in each phase to determine inter-observer agreement (IOA) for dependent variable measures. Table 4 presents IOA results for measuring challenging behavior in each phase. For the FA phase, IOA 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%. For the

preference assessment phase, IOA for the frequency of challenging behaviors was calculated by using a Mean Counter-per-Interval method in which the lower frequency of the target behavior was divided by the higher frequency within each interval. These fractions were then summed across all intervals, divided by the total number of intervals in the session, and multiplied by 100% (Cooper, Heron, & Heward, 2007). The mean IOA for the FA was 97.5 % and the mean IOA for the preference assessment was 97.1%, 96.7%, and 95.6% for each format. Table 4 reports IOA results for both procedures.

Table 4: Inter-observer Agreement

	Functional Analyses	Preference Assessments		
		PS	FO	MSWO
Britton	100%	93.5%	100%	93%
Carlos	98%	100%	100%	94.7%
	(R= 93- 100%)			
Donovan	96%	92%	96.5%	93%
	(R=87- 100%)			
Sharon	100%	97%	100%	95%
Mason	99%	100%	100%	94.7%
	(R= 97- 100%)			
Neo	92%	91.4%	77.7%	90%
	(R= 90-100 %)			
Fred	98%	100%	96.7%	100%
	(R=93-100 %)			
Sarah	100%	100%	100%	100%
Ellen	95%	100%	100%	100%
	(R=90-100%)			
Mean	97.6%	97.1%	96.7%	95.6%
	(R=87-100%)	(R= 91.4-100 %)	(R= 77.7- 100%)	(R= 90- 100%)

Procedural Fidelity

Secondary coders assessed procedural fidelity during 30% to 33% of the FA and preference assessment sessions using procedural checklists for implementations of each FA and preference assessment. Procedural checklists provided in Appendix A and B. Each checklist was comprised of several steps into which an assessment procedure was broken down, using a task analysis procedure. The coders evaluated whether or not the experimenter conducted each specific step accurately as described in the related protocol during functional analyses and preference assessments. Procedural fidelity was calculated by dividing the number of steps completed accurately by the total number of steps in each condition/format, and multiplying the result by 100%. For the FA, mean procedural fidelity was 99% (range 96.7% to 100%) and, for the preference assessments, mean procedural fidelity was 100%. Table 5 presents procedural fidelity results for both procedures.

Table 5: Procedural Fidelity

	Functional Analyses	Preference Assessments		
		PS	FO	MSWO
Britton	98%	100%	100%	100%
Carlos	100%	100%	100%	100%
Donovan	100%	100%	100%	100%
Sharon	100%	100%	100%	100%
Mason	100%	100%	100%	100%
Neo	100%	100%	100%	100%
Fred	96.7%	100%	100%	100%
Sarah	100%	100%	100%	100%
Ellen	100%	100%	100%	100%
Mean	99% (R=96.7-100%)	100%	100%	100%

Procedures

Phase1: Functional Analysis

In order to identify the function maintaining target challenging behaviors, a FA was conducted across four distinct conditions; attention, tangible, escape, and free play. The duration of each condition was five minutes. This analysis utilized procedures described by Iwata, Dorsey, Slifer, Bauman, & Richman (1982/1994).

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 upon challenging behavior,

the implementer delivered verbal attention, and brief physical contact (e.g., rubbing the participant's back). 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 upon challenging behavior, the participant was given access to the toy for 10-s. Toys used were selected based on a PS preference assessment implemented prior to the study. During the escape condition, a demand based upon the participant's individualized education plan (IEP) was given. A least-to-most prompting sequence (i.e., verbal, model, and physical guidance) was used. Contingent upon challenging behavior, the implementer withdrew the task demand by ceasing the prompting and removing the task materials. In the absence of the challenging behavior, the demand was reinstated following a 10-s break. During the free-play condition, the implementer interacted with the participant by delivering attention (i.e., praise and physical contact), at least once every 30-s, free access to toys was provided, and no demands were given.

During the functional analysis, if the child engaged in one of the defined topographies of challenging behavior, the programmed consequence was delivered immediately. In most instances target behaviors ceased when consequences were delivered. For example, contingent upon Carlos hand-mouthing in the tangible condition, the implementer offered him the toy and he removed his hands from his mouth to grasp the item. In cases in which the challenging behavior did not cease with the delivery of the 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 challenging behavior was identified via a modified FA (Lalli & Kates, 1998) because he engaged in his challenging behavior (i.e., elopement) even when the implementer delivered the programmed consequence. For example, in the tangible condition, Fred eloped even after access to the toy was provided and, in the escape condition, he continued eloping after the task demand and materials were removed. Based on observations made during the functional analysis, (e.g., looking over his shoulder as he ran away smiling) it seemed that elopement may have been sensitive to attention. Specifically, he may have wanted the implementer to give chase. Conceptually, this meant that he may have been attempting to access attention during conditions in which attention was not a programmed consequence. Therefore, in order to control for attention, the implementer delivered attention in the form of eye contact and/or verbal interaction continuously during all FA conditions except the attention condition.

Phase 2: Preference Assessments

Each preference assessment format was administered 5 times in a random order, resulting in a total of 15 assessments for each participant. One preference assessment procedure was conducted for each participant per day. The duration of each assessment administration 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). During the PS format, 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 then the participant was allowed to interact with it for 20-s. If the participant did not select either item within 5-s, the

implementer removed the current items and presented the next pair. The presentation order of item pairs was determined randomly, with the exception that the same pair was not presented in consecutive trials. A minor modification to the PS procedures described by Fisher et al. was made as an additional control for the potential of the items' position in the pair (left or right side) to bias the participant's selection (e.g., a participant may always chose 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 counter-balanced way so that each item in the pair appeared on the left and right side.

Multiple-stimulus without replacement procedure. The MSWO format was implemented as described by DeLeon et al. (2001). During the MSWO format, all six items were presented to the participant in a straight line on a table approximately 5cm apart. The participant sat approximately 0.3 m from the array and was instructed to choose one item. After selection, access to the item was allowed for 20-s. After 20-s the item was removed and was not presented again during the session. Prior to the next trial, items were rearranged to reduce the effects of a potential position bias. These procedures were continued until all items were selected and removed, or until the participant did not select an item within 30-s.

Free operant procedure. The FO format was implemented as described by Roane et al. During the FO format, all six items were placed approximately 5cm apart in a straight line on a table. The participant sat approximately 0.3m from the item array and was free to access any item, multiple items, or none at all. No item was withdrawn from

the participant and no demands were given. The session was 5-min in duration and began when the implementer left the assessment area (i.e., moved at least 2 m away).

Experimental Design

Multi-element designs were used to demonstrate experimental control during both study phases (i.e., functional analysis and preference assessment). The reason for examining the two procedures in which preferred stimuli were withdrawn was to determine if the results for frequency of challenging behavior yielded from one procedure were replicated in the other procedure.

CHAPTER 4

RESULTS

Results of FA

Figure 1 displays the functional analysis results with each panel demonstrating the data from each participant. The first two panels present the data for Britton and Carlos. Britton engaged in his challenging behavior only during the tangible condition (*M* = 65% of intervals; range 47% to 80%) and did not show the behavior in the rest of conditions. These results demonstrate that Britton's challenging behavior was maintained by access to the preferred tangible item. Carlos' challenging behavior also occurred primarily in the tangible condition (*M* = 22% of intervals; range, 3% to 43%) with lower levels during escape (*M* = 4% of intervals; range, 3% to 17%), and attention conditions (*M* = 3% of intervals; range, 3% to 13%). No challenging behavior occurred during the play condition. Although less differentiated responses occurred in the final sessions of the functional analysis, overall, Carlos' results suggest his challenging behavior is maintained by access to tangible items. For Donovan, higher levels of challenging behavior occurred in the tangible condition (*M* = 43.2% of intervals; range, 20% to 70%) relative to the control play condition (*M* = 5% of intervals; range, 0% to 27%). Levels of challenging 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 control. Therefore, despite the slight increase during the escape condition towards the end of assessment, Donovan's data suggest a tangible function for challenging behavior. Sharon's challenging behavior occurred almost exclusively in the tangible

condition (*M* = 58% of intervals; range, 30% to 70%), rarely occurred during escape (*M* = 1.4% of intervals; range, 0% to 7%), and play (*M* = 0.6% of intervals; range, 0% to 3%) conditions and was not observed during the attention condition. These data suggest that Sharon's challenging behavior was maintained by access to tangible items. Mason engaged in his challenging behavior primarily in the tangible condition (*M* = 16.7% of intervals; range, 13.3% to 30%) with lower levels in during escape (*M* = 5.9% of intervals; range, 0% to 23%), attention (*M* = 2.7% of intervals; range, 0% to 6.7%), and play (*M* = 1.3% of intervals; range, 0% to 6.7%) conditions. These data demonstrate that Mason's challenging behavior was maintained by access to tangible items.

For Neo, the highest levels of challenging behavior relative to the control condition occurred during the attention condition (*M* = 46% of intervals; range, 37% to 63%) with lower levels of challenging 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, demonstrating that Neo's challenging behavior was maintained by attention. The results of the modified FA for Fred showed the highest levels of challenging behavior were observed during the attention condition (*M* =57% of intervals; range, 47% to 87%) with lower levels of challenging 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 suggest that Fred's challenging behavior was sensitive to attention.

Sarah's challenging 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 challenging behavior was observed in the play condition. These data suggest that Sarah's challenging behavior was maintained by escape. Ellen's challenging behavior occurred primarily in the escape condition (*M* = 31% of intervals; range, 20% to 40%) with lower levels of challenging behavior in the tangible condition (*M* = 6% of intervals; range, 3% to 13%) and none in the attention or play conditions. These data suggest that Ellen's challenging behavior was maintained by escape. In summary, the FA results indicated that five of the children's behaviors were maintained by access to tangible items, two by getting attention, and two by escape.

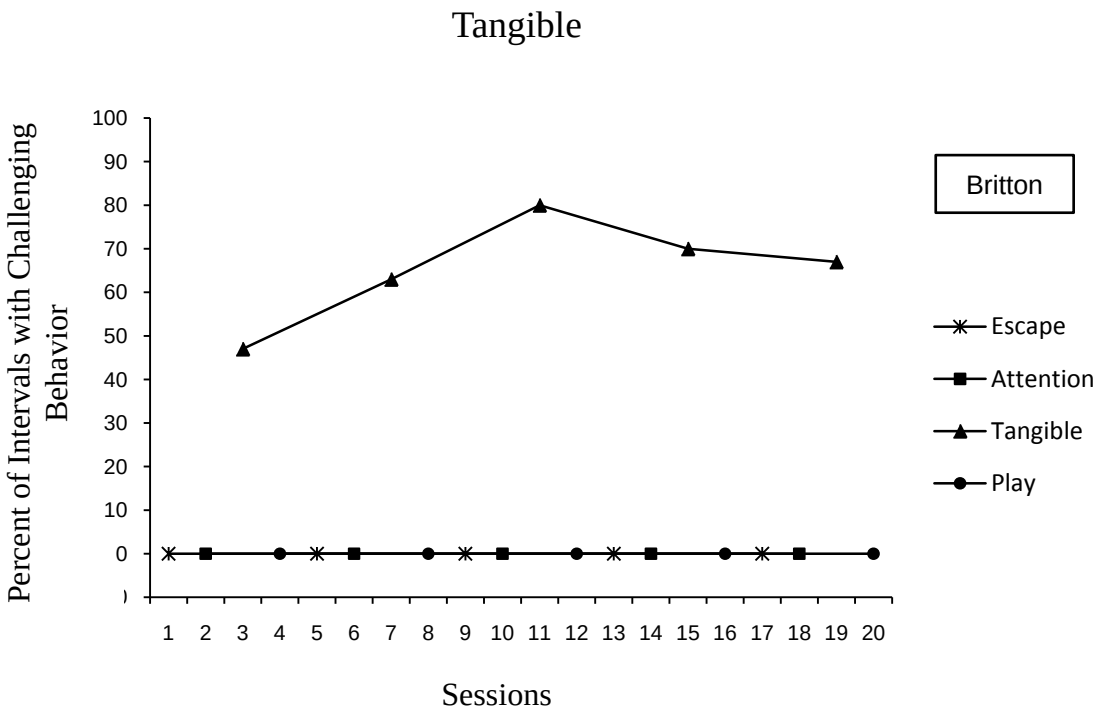


Figure 1: Functional Analysis Results for Britton

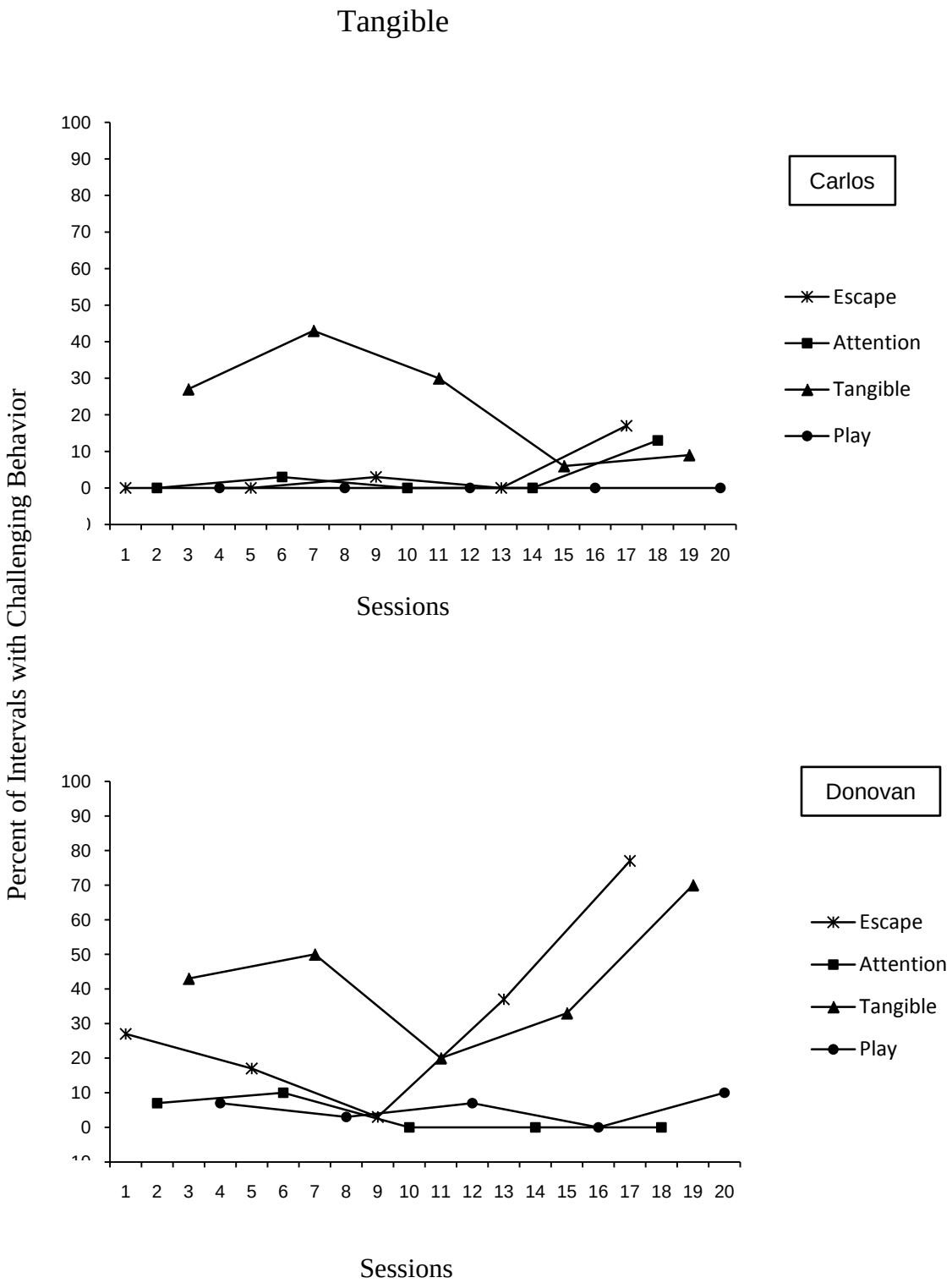


Figure 2: Functional Analysis Results for Carlos and Donovan

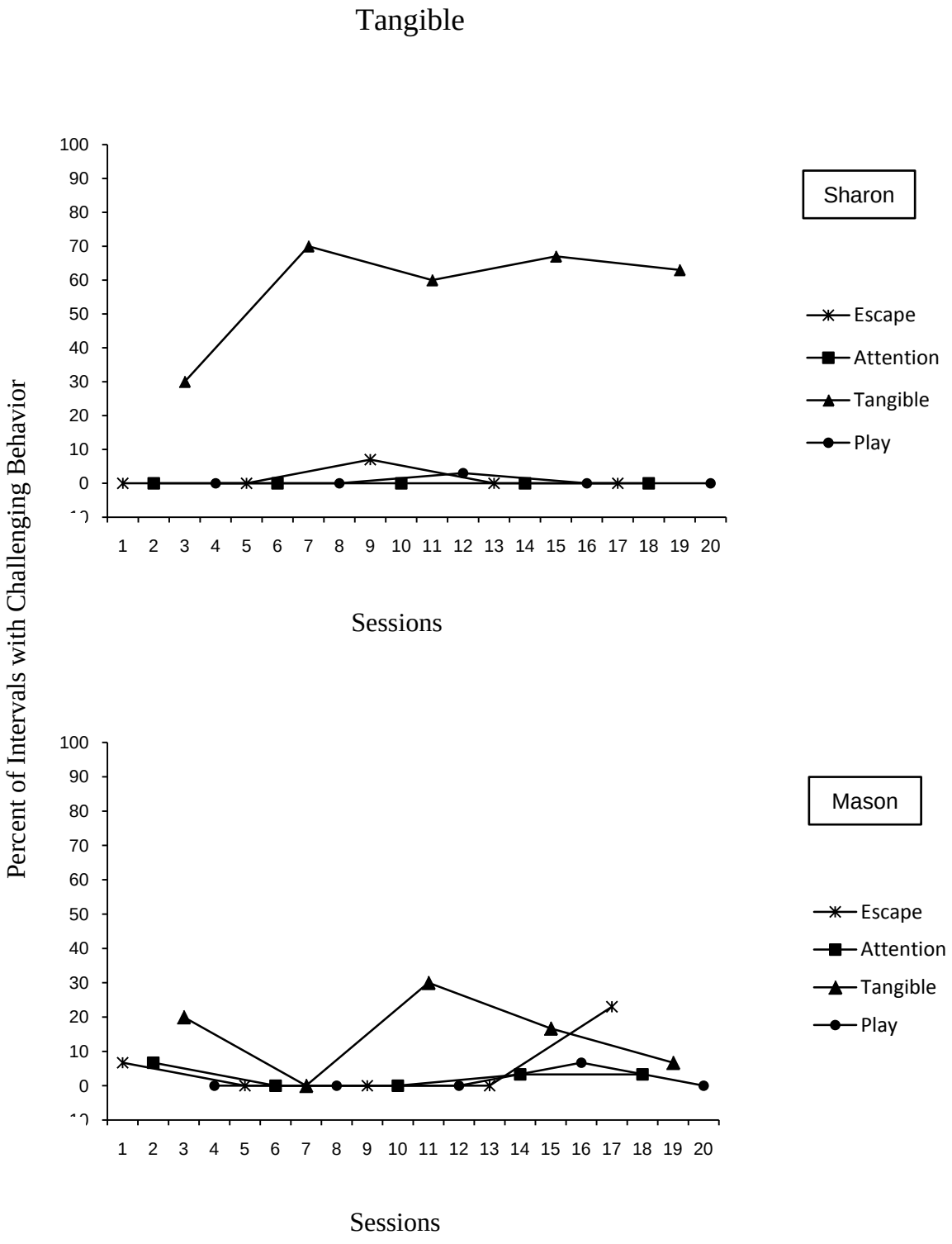


Figure 3: Functional Analysis Results for Sharon and Mason

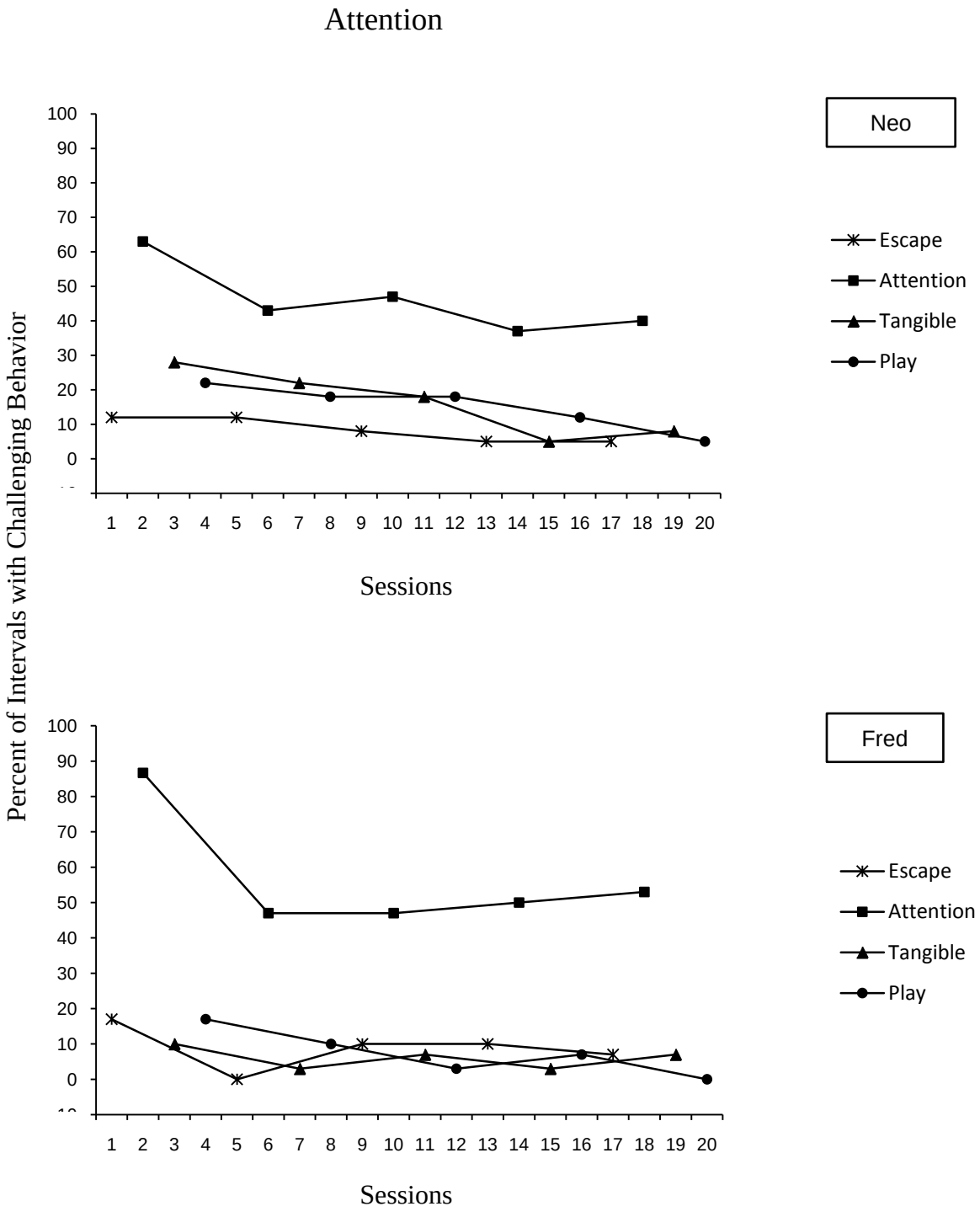


Figure 4: Functional Analysis Results for Neo and Fred

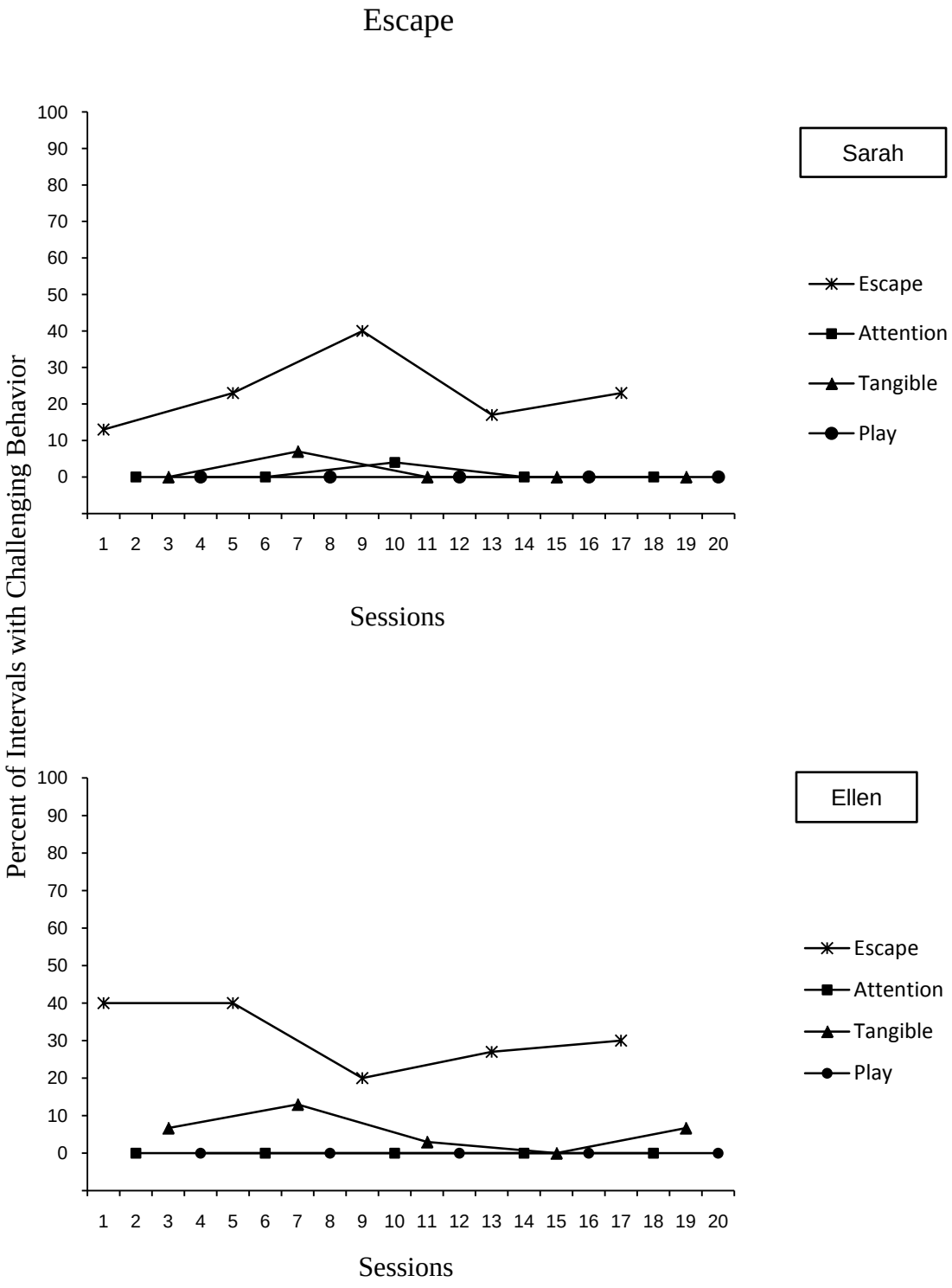


Figure 5: Functional Analysis Results for Sarah and Ellen

Results of preference assessments

Figure 2 presents the rates of challenging behavior for each participant across the three preference assessments. The first five panels display the data for the participants with tangibly maintained challenging behavior (i.e., Britton, Carlos, Donovan, Sharon, and Mason). The next two panels display the data for the participants with attention maintained challenging behavior (i.e., Neo and Fred). The final, two panels display the data for participants with escape maintained challenging behavior (i.e., Sarah and Ellen).

Challenging behaviors maintained by access to tangible items

The rates of Britton's challenging behavior were higher in both the PS (*M* = 2.1 responses per min [RPM]; range, 1.9 to 2.3) and MSWO (*M* = 1.2 RPM; range, 1.2 to 2.0) and never occurred in the FO. For Carlos, similarly high rates of challenging behavior occurred during the PS (*M* = 1.3 RPM; range, 1.1 to 1.6) and MSWO (*M* = 1.1 RPM; range, 0.8 to 1.6) formats. During the FO format, the rates were near zero (*M* = 0 RPM; range, 0 to 0.1). Donovan's challenging behavior also occurred most often during the PS (*M* = 1.0 RPM; range, 0.5 to 1.7) and MSWO (*M* = 1.8 RPM; range, 0.5 to 2.7) formats with near zero challenging behavior during FO (*M* = 0 RPM; range, 0 to 0.2). For Sharon, high rates of challenging behavior occurred during the PS (*M* = 2.3 RPM; range, 0.3 to 5.2) and MSWO (*M* = 1.1 RPM; range, 0.3 to 5.6). The high rates in both formats exhibited decreasing trends over sessions. Sharon exhibited no challenging behavior during the FO format. Mason showed high rates of challenging behavior in the MSWO (*M* = 2.0 RPM; range, 1.4 to 2.3) followed by the PS (*M* = 0.3 RPM; range, 0 to 1.3). He also did not show his challenging behavior during the FO format.

Challenging behaviors maintained by attention

For Neo, the highest rates of challenging behavior occurred during the FO format (*M* = 6.0 RPM; range, 4.4 to 7.8) with lower levels during the PS (*M* = 1.4 RPM; range, 1.1 to 1.8) and MSWO (*M* = 0.6 RPM; range, 0 to 1.2) formats. For Fred, high rates of challenging behavior also occurred during the FO format (*M* = 1.5 RPM; range, 0 to 1.8), and very low rates were observed during the PS (*M* = 0.2 RPM; range, 0 to 0.5) and MSWO (*M* = 0.1 RPM; range, 0 to 0.3) formats.

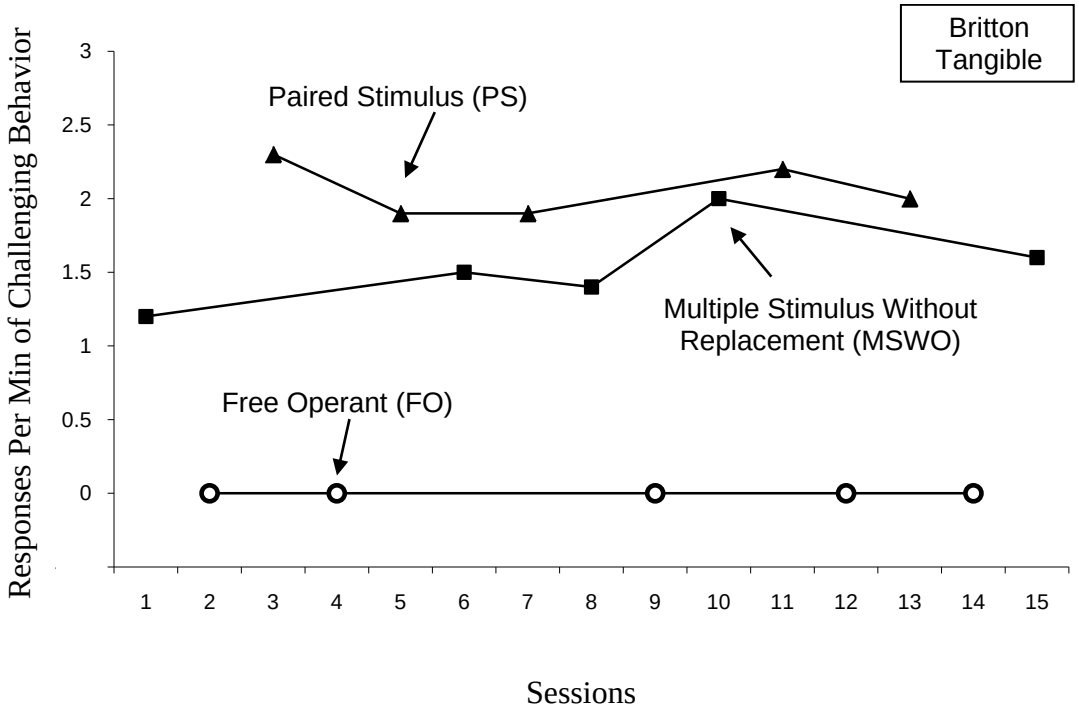


Figure 6: Responses Per Minute of Challenging Behavior for Britton during Preference Assessments

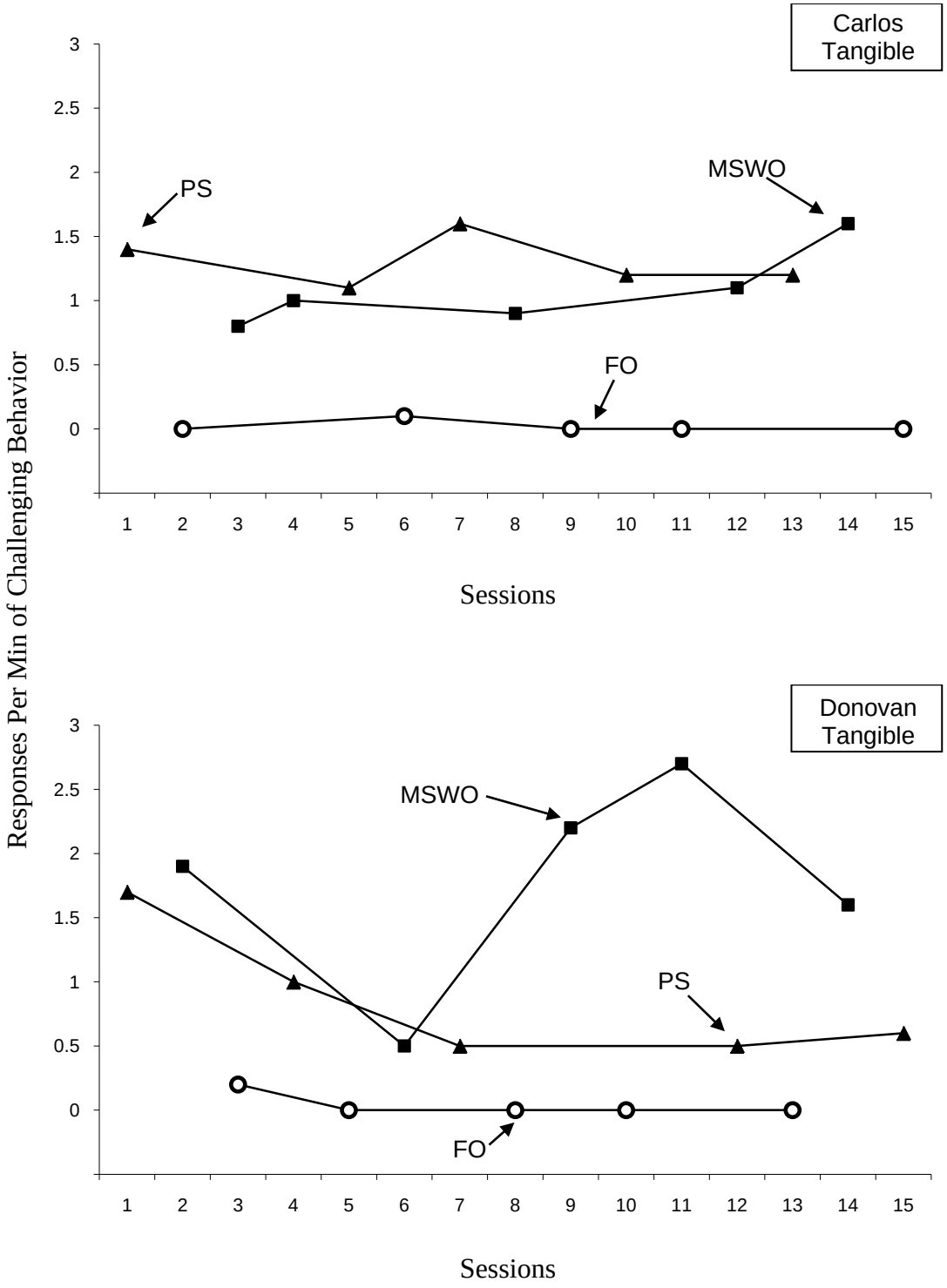


Figure 7: Responses Per Minute of Challenging Behavior for Carlos and Donovan during Preference Assessments

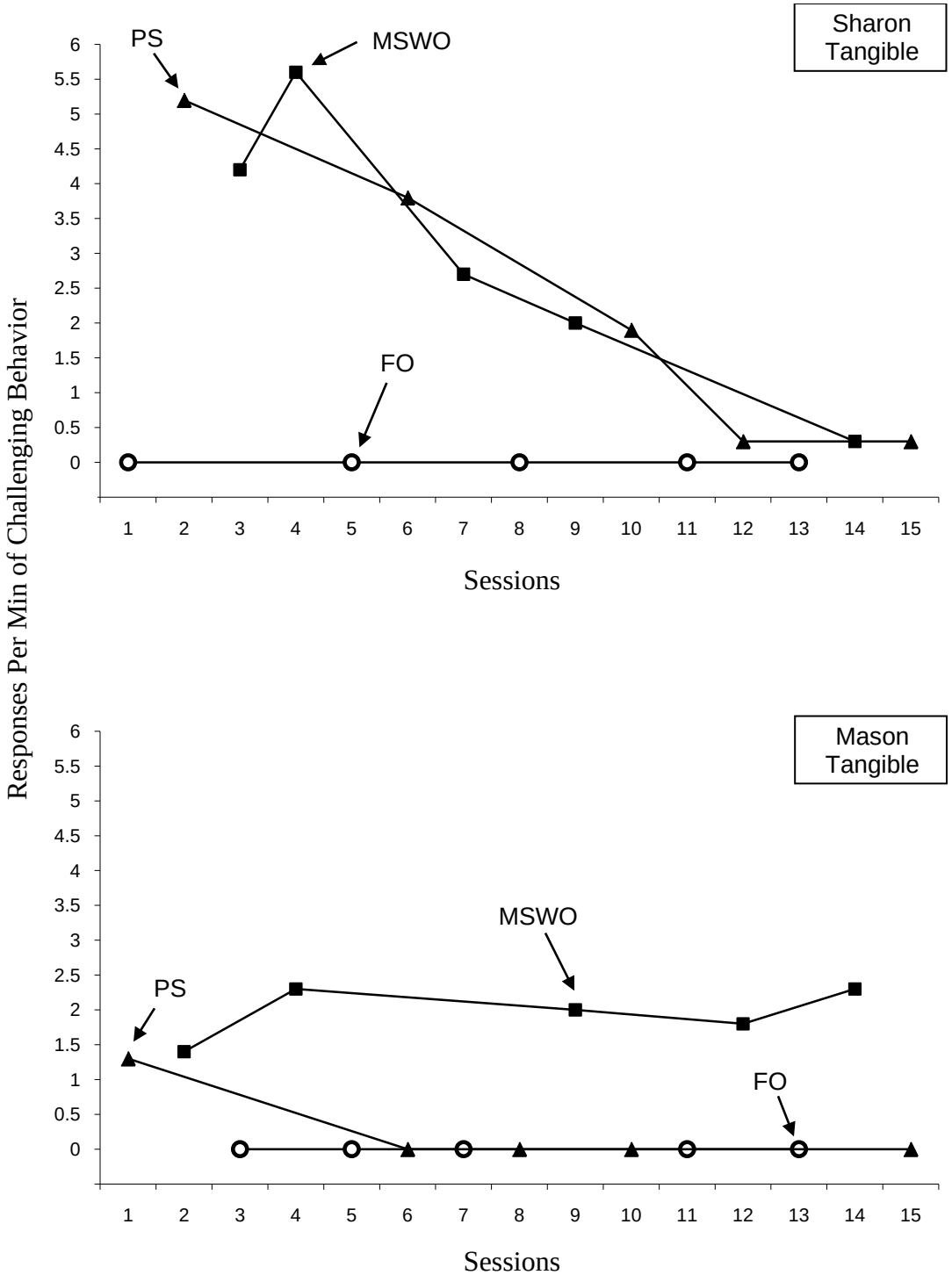


Figure 8: Responses Per minute of Challenging Behavior for Sharon and Mason during Preference Assessments

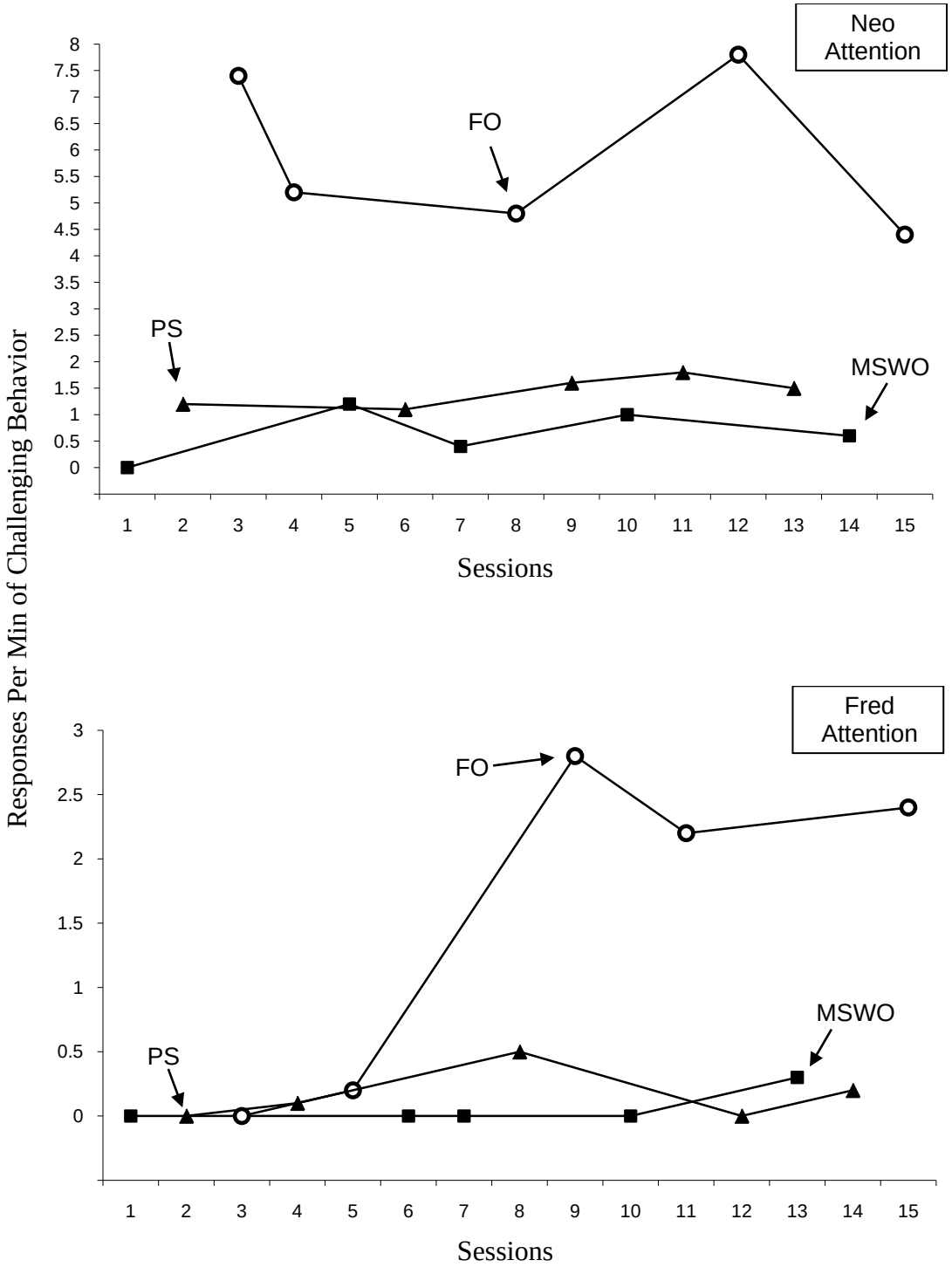


Figure 9: Responses Per Minute of Challenging Behavior for Neo and Fred during Preference Assessments

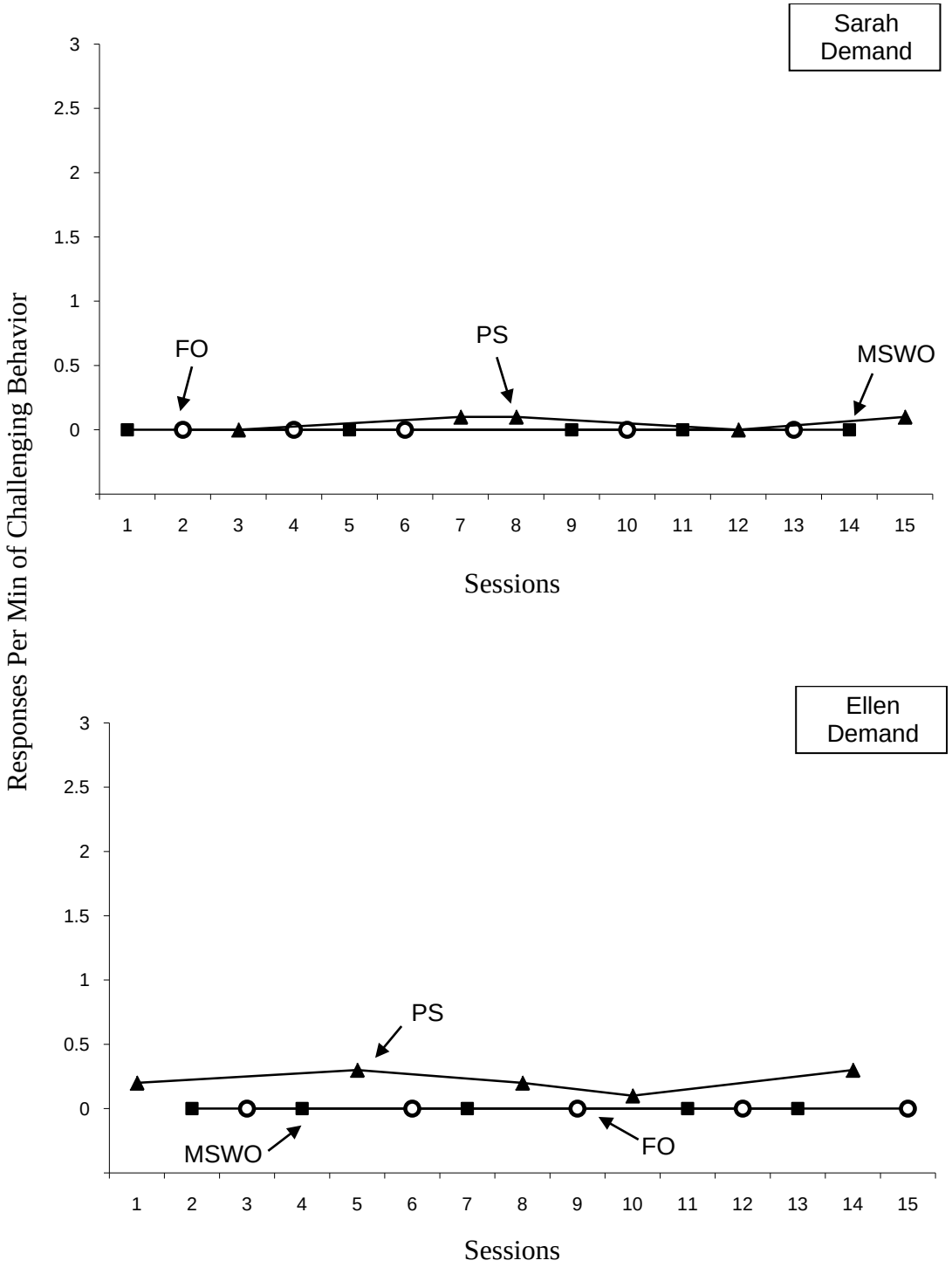


Figure 10: Responses Per Minute of Challenging Behavior for Sarah and Ellen during Preference Assessments

Challenging behaviors maintained by escape

For Sarah, the rates of challenging behavior were zero or near zero during all formats (PS; *M* = 0.06 RPM; range, 0 to 0.1). Similar to Sarah's data, the rates of Ellen's challenging behavior were zero during MSWO and FO and near zero during PS (*M* = 0.2 RPM; range, 0.1 to 0.3).

Within-session analysis

Using the videotapes of the preference assessment sessions, a within-session analysis was conducted to determine when challenging behavior occurred during each assessment format. Challenging behaviors were recorded if they occurred immediately after one of the following: (a) the implementer delivered an instructional demand (i.e., "chose 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 challenging behavior occurring following "a," "b," or "c" was collected and converted to a percentage of the total challenging behavior that occurred during the entire session by dividing the frequency of challenging behavior occurring in either "a," "b," or "c" and dividing by the challenging behavior occurring in a + b + c. The percentages of challenging behavior in "a," "b," and "c" were then compared for each participant. Figure 3 displays these results.

Participants with challenging behavior maintained by access to tangible items

For Britton, 99% of his challenging behaviors followed the withdrawal of an item, the final 1% occurred when he had access to items but reduced attention, and no challenging behavior occurred when the implementer asked him to choose between items.

For Carlos, 80% of his challenging behaviors occurred following the withdrawal of an item. Another, 10% of his problem behavior occurred when he had access to items but reduced attention, and the final10% occurred when the implementer asked him to choose between items. For Donovan, 84% of his challenging behaviors occurred following the withdrawal of an item, 9% when he had access to items but reduced attention, and 7% when the implementer asked him to choose. For Mason, 94% of his challenging behaviors occurred following the withdrawal of an item, 2% when he had access to items but reduced attention, and 4% when the he was asked to choose between items.

Participants with challenging behavior maintained by attention

For Neo, 88% of his challenging behavior occurred when he had access to items but reduced attention, 6% when the implementer withdrew the item, and 5% when the implementer asked him to choose. For Fred, 62% of his challenging behavior occurred when he had access to items but reduced attention, 23% when the implementer withdrew the item, and 15% when the implementer asked him to choose.

Participants with challenging behavior maintained by escape

Sarah and Ellen never displayed their challenging behaviors during either the MSWO or FO formats. They showed very low rates of challenging behavior during the PS format. For Sarah, 67% of all her challenging behavior (3 occurrences) occurred when the implementer asked her to choose in the PS. Thirty-three percent (1 occurrence) occurred when she had access to items but reduced attention. No challenging behaviors occurred when the implementer withdrew an item. For Ellen, 95% of all her challenging behavior occurred when the implementer asked her to choose in the PS. Five percent of

her challenging behavior occurred when she had access to items but reduced attention. No challenging behaviors occurred when the implementer withdrew an item.

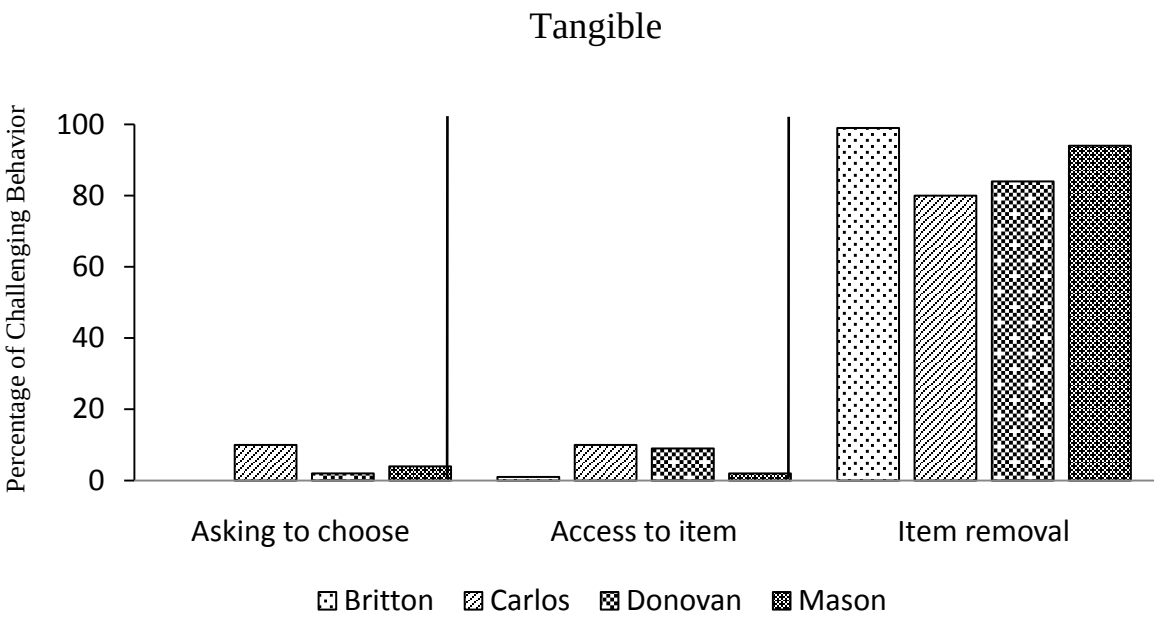
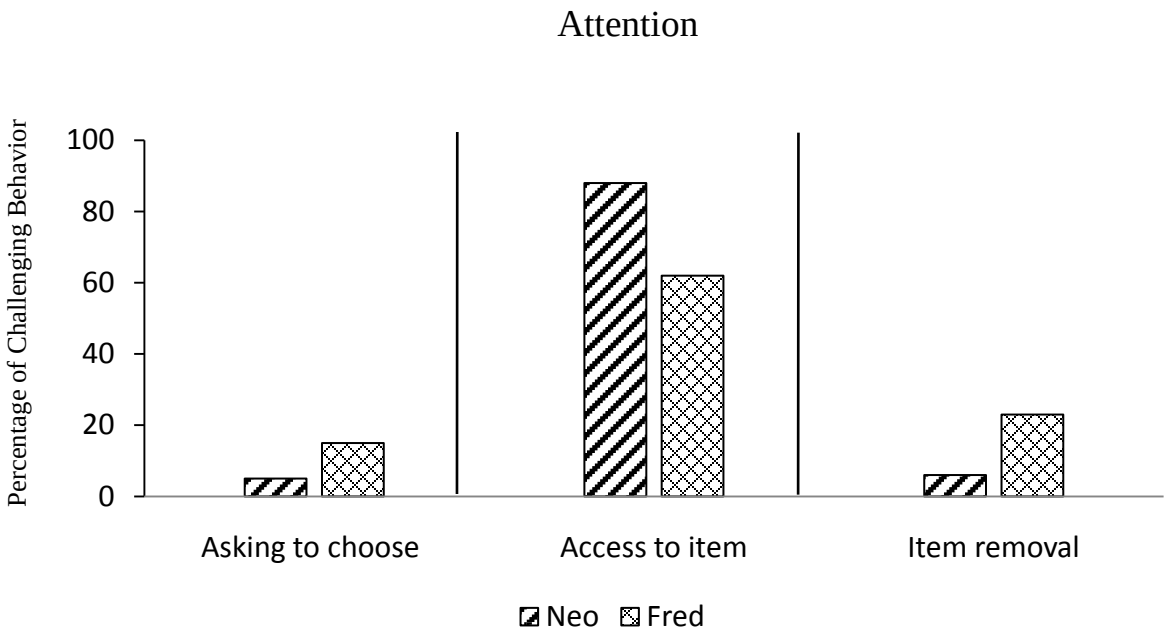


Figure 11: Results of the Within-Session Analysis for Challenging Behaviors Maintained by Access to Tangible Items



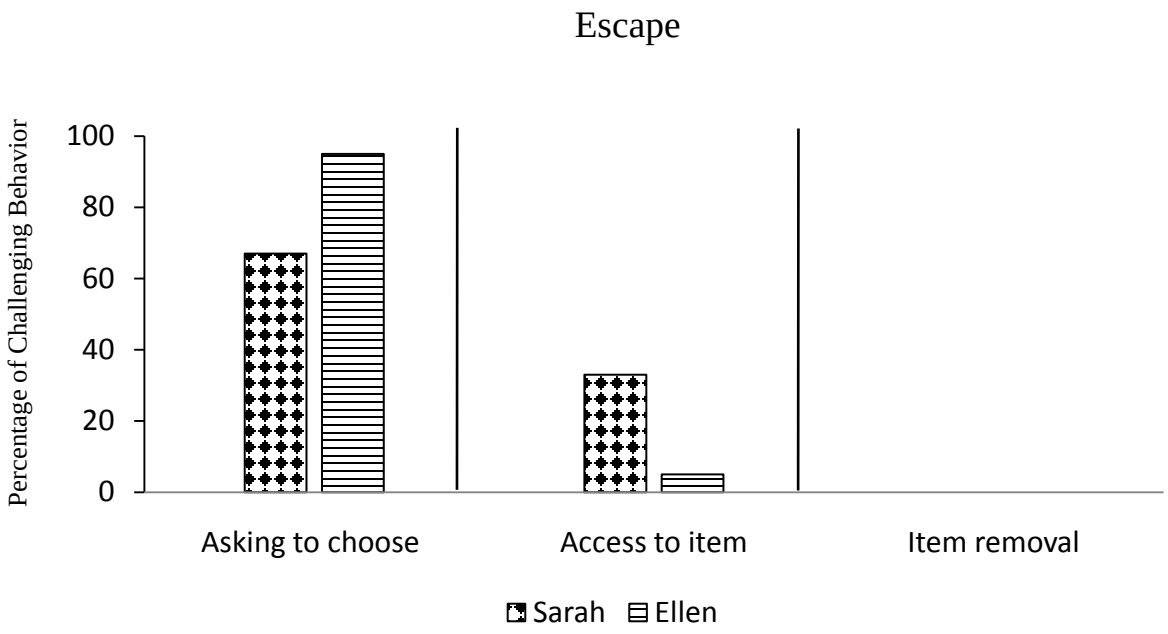


Figure 12: Results of the Within-Session Analysis for Challenging Behaviors Maintained by Attention or Escape

CHAPTER 5

DISCUSSION

The present study examined the occurrence of challenging behavior maintained by different reinforcers across different preference assessment formats. Nine children with autism and developmental disabilities participated in this study. In phase 1, the function of the challenging behavior for each participant was identified using a functional analysis. The FA results indicated that the challenging behaviors of five participants were maintained by access to tangible items, two participants' challenging behaviors were maintained by getting attention, and two were maintained by escape reinforcer. In phase 2, after identifying the behaviors' functions, three commonly used preference assessments (i.e., PS, MSWO, and FO) were conducted for each participant. Then the rates of challenging behavior across assessment formats were compared. Each preference assessment format was conducted 5 times in a random order for each participant. Data were collected on challenging behavior using a frequency count, which was then converted to the rate of challenging behavior per minute.

It was hypothesized that a) challenging behavior maintained by access to tangible items would occur at higher rates during PS and MSWO formats in which tangible items are withdrawn relative to the FO format in which tangible items are not withdrawn; b) challenging behavior maintained by attention should be more frequent during the FO format in which fewer interactions between the implementer and participant occur relative to the MSWO and PS formats in which physical and verbal attention are delivered during each trial; and c) challenging behavior maintained by escape would

occur at higher rates during the PS and MSWO formats in which instructional demands are provided relative to the FO format in which instructional demands are not given. In addition, this study conducted a within-session analysis for the results to identify when challenging behavior actually occurred within each assessment format. In other words, it was noted if challenging behavior occurred when items were taken away from the child, the child was asked to choose between items, or the child had access to the items and no attention from the implementer.

Results reveal that the occurrence of challenging behaviors during preference assessment may be more probable in the format where the related trigger condition is present than where it is absent. Possible explanations for each potential function-format interaction evaluated in this study are as follows. First, because the PS and MSWO formats require items to be repetitively withdrawn, participants with challenging behavior maintained by access to tangible items may be more likely to engage in challenging behavior in an effort to maintain access to the items. Second, because the FO format involves less interaction between the implementer and the participant, participants with attention maintained challenging behavior may be more likely to engage in challenging behavior in an effort to obtain attention from the implementer.

These results were clearly supported by the within session analysis that revealed that the point in time in which challenging behavior occurred was often immediately preceded by the trigger condition most likely to be associated with the function of the challenging behavior. As demonstrated by the within-session results, challenging behavior maintained by access to tangible items was evoked primarily when the provided

items were withdrawn in the PS and MSWO procedures, involving the item removal condition. Challenging behavior maintained by getting attention was also evoked primarily during absent of attention from the implementer in the FO in which relatively few interactions were between implementer and participants.

The results of the within-session demonstrated that challenging behavior maintained by a specific function occurred mainly when the relevant condition that may evoke challenging behavior was present during the formats. Such results support even more strongly the different tendencies of challenging behavior across the formats, which present the relevant condition differently. Therefore it is reasonable that challenging behavior with different functions occurred differently across formats. These findings provide empirical support for the proposal by Roane et al.'s of an interaction between challenging behavior function and different preference assessment formats (except in the case of escape maintained challenging behavior described below).

In this study the third hypothesis was not supported. Specifically, the delivery of instructional demands for participants with escape maintained challenging behavior during the PS and MSWO did not result in high rates of challenging behavior. Challenging behavior occurred at very low rates in PS and did not occur in the MSWO or FO formats. One potential explanation for the paucity of escape maintained challenging behavior in the PS and MSWO formats may be related to the putative qualities of the instructional demands. The property of demands in PS and MSWO may be different from the property of instructional demands used in teaching skills not yet mastered. Specifically, the instructional demand given within the PS and MSWO formats (i.e., to

select a toy) may not be sufficiently aversive in terms of the effort required by the individual (i.e., reach for a toy) to elicit escape maintained behavior. Therefore the instructional demands almost never evoked their challenging behavior. Further, Lalli et al. (1999) found that reinforcement of compliance with preferred items is a potentially effective intervention for decreasing escape maintained challenging behavior. However, under certain conditions not evaluated in this present study it is possible that escape maintained behavior may become more likely. For example, if the items used in a preference assessment are not actually preferred items and the participant is asked to choose between them, or if a preference assessment is long in duration, (e.g., towards the end of a PS containing many items) the value of escape may be increased and escape maintained behavior subsequently more likely. Although not conducted within the context of a preference assessment, previous research has demonstrated several dimensions in the properties of demands (e.g., difficulty, task preference, and duration of instructional sessions), as variables responsible for evoking challenging behavior maintained by escape (McGill, 1999).

Implications for Practice

The results from the present study suggest several practical implications for teachers and practitioners. To the extent challenging behavior impedes the accurate or complete implementation of a preference assessment, the results of the assessment may be inaccurate. Therefore, when selecting the specific preference assessment format to be used with an individual who engages in challenging behavior it may be beneficial to consider the function of the challenging behavior. This consideration involves identifying

the preference assessment format containing conditions less likely to evoke challenging behavior or a format with procedures more likely to attenuate challenging behavior. For example, the PS and MSWO formats contain more interactions between the implementer and participant and may, therefore, be preferable for individuals with attention maintained challenging behaviors. However, for individuals with tangible maintained challenging behavior, the FO format, which does not require the withdrawal of tangible items, may be more suitable.

Although reduced likelihood of challenging behavior during preference assessment is an important factor for consideration, it must be mentioned that this is not the sole factor; ultimately, the preference assessment approach utilized must be selected considering multiple factors. For example, the FO format yields less information regarding relative preferences because it is unlikely to allow a ranking of most to least preferred items (Deleon et al., 1999; Worsdell et al., 2002). Therefore, if an individual engages in tangibly maintained challenging and a rank order of preferred items is needed, a possible approach would be to conduct multiple FO sessions across a span of time and, between sessions out of sight the participant, remove the most highly preferred item from the array. In this way a rank order may emerge over time, while still using a procedure less likely to evoke challenging behavior than other options.

Modifications of preference assessments. When challenging behavior is maintained by tangible reinforcers, a modification to the PS format that may be beneficial is to show the participant the next pair of items prior to the removal of the current items. This could potential call the participant's interest to the new pair and make the removal

of the previous pair less aversive. Second, it may be beneficial to limit the number of items assessed so as to reduce the number of withdrawals required.

MSWO format could also be adapted in such a way to reduce the likelihood of tangible maintained challenging behavior. Instead of a preset access time (e.g., 20-s), the participant could be allowed access for a sufficient period. This may temporarily reduce the reinforcing value of the item, decreasing the likelihood of challenging behavior when it is withdrawn. This approach would not be advisable in the PS format because the reduced reinforcing value could alter selection in subsequent pairings involving that item and result in inaccurate preference results. However, during the MSWO format in which items are removed from the array following selection, longer access to the item may serve to reduce challenging behavior without compromising the results.

Many individuals with developmental disabilities engage in challenging behavior maintained by multiple reinforcers (e.g., attention, tangible items, and escape; O'Reilly et al., 2010). For these individuals consideration of a function-format interaction is complicated by multiple reinforcers. Based on the results of the present study, the optimal format may be one of the modifications to existing formats described above. For example, for individuals whose challenging behaviors are maintained by attention and tangible reinforcers, a modified FO format in which items are not withdrawn but the implementer delivers a dense schedule of non-contingent attention may be appropriate. A second potential suggestion would be a modified MSWO in which the implementer non-contingently delivers his/her attention with a dense schedule during a longer item access

period and redirects the participant's attention to the remaining items when the chosen item is withdrawn.

For individuals whose challenging behavior is maintained by attention and escape, current MSWO and PS formats would be recommended in that the participant can obtain attention by the inherent presentation style of the formats and the instructional demand to make a choice does not serve as an aversive event. For individuals whose challenging behavior is maintained by tangible and escape reinforcers, the current FO format may be optimal because it does not likely involve any conditions that might evoke challenging behavior maintained by tangible and escape reinforcers. For individuals whose challenging behavior is maintained by attention, tangible, and escape reinforcers, the same modified FO format or modified MSWO format as used for the challenging behaviors maintained by attention and tangible reinforcers would be suggested.

Another application of the results of this study involves the use of preference assessments in the generating hypothesis regarding challenging behavior function prior to conducing a functional assessment. This may be particularly practical when a functional analysis cannot be conducted. It may also be useful given that practitioners may need to conduct preference assessments before information regarding behavioral function has been obtained (e.g., preference assessment used to identify items for a functional analysis). In cases in which the function of challenging behavior is not known, selecting an initial format that can be the most advantageous in the given conditions (e.g., available administration time, the number of needed preferred items, or type of examining items) is suggested. Then if challenging behavior disturbs the initial format, a hypothesis regarding

the function could be generated. Based on the generated hypothesis, shifting to the predicted preferable assessment format may avoid the challenging behavior. For example, if a participant engages in challenging behavior when the implementer withdraws items during the PS, it would be hypothesized that the function of the challenging behavior is access to tangible items. Therefore an alternative may be to change to the FO format in which no items are withdrawn. If the challenging behavior decreases when the FO format is used, this may support the hypothesis.

Limitations and future research

A few cautions should be considered when interpreting the results of this current study. First, as mentioned above, there are several factors that need to be considered when selecting which preference assessment format to utilize, for example, the availability of resources (Hagopian et al., 2004), the duration of administration time (DeLeon & Iwata, 1996; Roane et al., 1998), and the need of multiple stimulus preferences (DeLeon et al., 2001). The function of challenging behavior is only one important variable to consider when selecting a preference assessment format. Second, there may be individual differences for the levels of attention needed to decrease challenging behavior and the instruction may or may not serve as an aversive event. In other words, even though the PS and MSWO formats involve more social interactions between implementer and participant than the FO format, the quantity or quality of attention involved in the procedures may not be sufficient to attenuate attention maintained challenging behavior for some individuals. In the event that attention maintained challenging behavior impedes implementation of the PS or MSWO format,

perhaps the non-contingent delivery of multiple forms of attention (e.g., physical and social) on a dense schedule during the item access period may be beneficial.

In regards to escape maintained challenging behavior, the instructional demand to select an item given to participants during the PS and MSWO formats did not evoke escape maintained challenging behavior in this study. However, for some individuals with developmental disabilities, selecting between items may be a difficult or aversive task and may evoke challenging behavior (Berotti, 1996). In that case, the FO format may be preferable; however, this interaction has not yet been empirically demonstrated in research. Therefore, the results of this study may have a limitation for individuals whose challenging behavior is maintained by attention or escape. In this respect cumulative evidence via further research for these populations is needed.

The current study suggested optimal formats and modifications to current formats to prevent challenging behavior maintained by single or multiple reinforcer(s) based on the results. However, these suggestions were not verified by experimental results. Therefore future research needs to examine the suggested formats and modifications. The results of the current study also suggest a potential utility that the preference assessment data may be used in generating preliminary hypotheses about the function of challenging behavior based on responding during certain preference assessments. Therefore future research can evaluate the validity of the preference assessment when a functional analysis cannot be conducted. Along with such a utility, it can be suggested that another potential utility of the preference assessment data in abridging the functional analysis process. For example, an alternative process for

identifying the function of challenging behavior would be to generate hypotheses about putative functions based on the challenging behavior observed during preference assessments, and then conduct only certain conditions (e.g., an alternate comparison between the reinforcing condition [A] and a non-reinforcing condition [B]) or a brief functional analysis by reducing the length of the functional analysis. In relation to this area, future research could also be to examine the validity of the alternative process to streamline the FA process in identifying the function of challenging behavior.

In addition, this study did not examine how the challenging behavior exhibited during preference assessments affected the individuals' choice outcomes. It may not be simple to verify the challenging behavior's influence based on the correspondence or consistency of the choice results because previous research could not obtain robust correspondence or consistency regarding choice results even when the challenging behavior variable was not included in the analysis (e.g., DeLeon et al., 2001; Hanley, Iwata, & Roscoe, 2006; Windsor et al., 1994). However, this study suggests that future research could examine how challenging behavior affected the completion of assessment procedures and/or the accuracy of the results. For example, future research could examine how often participants fail to select or engage with items during trials containing challenging behavior compared to trials absent challenging behavior, and/or whether the item identified as most preferred during a preference assessment containing challenging behavior was effective as a reinforcer.

Finally, during a preference assessment, children with autism spectrum disorders who often engage in repetitive behavior using items are likely to select the items with

which they can do their repetitive behavior. Consequently these identified highly preferred items for engaging in repetitive behavior are provided as reinforcers during educational intervention or instruction. In an educational perspective, it can be a problem when reinforcers unintentionally encourage the very behavior that an intervention is trying to reduce. The repetitive behavior dilemma needs to be addressed in conjunction with the in-depth functional properties evaluation of challenging behavior of children with autism spectrum disorders. Therefore, future research could examine an intervention that teaches play skills in place of repetitive behavior with an item given as a reinforcer.

APPENDIX A

Functional Analysis Procedure Fidelity Data Collection Sheet

Attention Condition	Complete	Incomplete
1. Implementer instructs the child to play with toys.		
2. Implementer tells the child to keep playing while the implementer is doing something.		
3. Implementer sits near the child with no attention (e.g., pretends to read a paper)		
4. Implementer ignores all the child's behaviors except his/her target challenging behavior.		
5. If the child displays his/her challenging behavior, the implementer contingently delivers attention.		

Tangible Condition	Complete	Incomplete
1. Implementer allows the child to access tangible for 10 seconds at the beginning of the condition.		
2. Implementer takes the item away and places it within view, but out of the child's reach.		
3. Implementer ignores all the child's behaviors except his/her target challenging behavior.		
4. Implementer blocks any attempts to access the tangible item.		
5. Contingent upon target behavior the implementer allows the child to access the item for 10 seconds and then removes it.		

Demand Condition	Complete	Incomplete
1. Implementer provides the child instruction to complete a task.		
2. If the child does not respond within 5 seconds, the implementer prompts the child using a least-to-most prompt hierarchy.		
3. Implementer does not give other interactions/praise irrelevant to the task completion.		
4. Contingent upon the target challenging behavior, the implementer stops the trial, removes the task material and does not give additional attention for 10 seconds.		
5. After 10 seconds, if the child ends the target behavior, the implementer re-provides the trial with the task.		

Play Condition	Complete	Incomplete
1. Implementer directs the child towards toys.		
2. Implementer interacts with the child in parallel or cooperative play		

delivering attention every 10 seconds.		
3. Implementer ignores the child's target challenging behavior and all other inappropriate behavior.		

APPENDIX B

Preference Assessment Procedure Fidelity Data Collection Sheet

PS Procedure

Student Name: Interventionist: Date:

Primary: Secondary:

TRIAL #			
PS Steps	Complete	Incomplete	N/A
1) Place two items approximately 0.7m apart on the table in front of the child.			
2) Wait 5seconds for the child to touch/say an item.			
3) If the child attempts to touch both items (or say one item but touch the other item), block the attempt by securing the items to the tabletop. Place the two items back on the original spots and instruct the child to select one item.			
4) If the child touches/says an item, remove the other item. If the child touches something other than an item (e.g., an arm holding one item) it should not be considered a choice.			
5) Allow the child to interact with the chosen item for 20 seconds.			
6) If the child does not touch/say either item for 5 seconds, remove them and move on to the next pair. Score both items as “not selected”.			

FO Procedure

Student Name: Interventionist: Date:

Primary: Secondary:

TRIAL #			
FO Steps	Complete	Incomplete	N/A
1) Place all items in a straight line on a floor/table. The child is free to access the stimulus array.			
2) During the given interval (i.e., 5 minute session), the child can manipulate any item, multiple items or none at all.			
3) Do not withdraw any items from the child.			
4) Seat the child approximately 0.3m from the stimulus array. The experimenter withdraws from the assessment area.			
5) The total of time of this procedure is 5 minutes.			

MSWO Procedure

Student Name: Interventionist: Date:

Primary: Secondary:

TRIAL #			
MSWO Steps	Complete	Incomplete	N/A
1) Place all items in a straight line on a floor/table, approximately 5cm apart.			
2) Seat the child approximately 0.3 m from the stimulus array and instruct the child to select one item.			
3) If the child attempts to touch more than two items (or say one item but touch another item), block the attempt and instruct the child again to select one item.			
4) Allow the child to interact with the chosen item for 20 seconds and block to touch another item until the given interval (i.e., 20 seconds) has elapsed.			
5) Remove the chosen item from the stimulus array.			
6) Prior to the next trial, rotate the sequencing of the remaining items by taking the item at the left end of the line and moving it to the right end, then shifting the other items so that they are again equally spaced on the floor/table.			
7) Continue this procedure until all items are selected or until the child does not select within 30 seconds from the beginning of a trial. In the latter case, terminate the session and code all remaining items as “not selected”.			

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