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PREDICTING PREFERENCE FOR ITEMS DURING PERIODS OF EXTENDED ACCESS BASED ON EARLY RESPONSE ALLOCATION

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Top-ranked items were identified during 30-min free-operant preference assessments for 9 individuals. Data from each session were analyzed to identify the item (a) that was engaged with first in each session and (b) to which the most responding was allocated after 5 min, 10 min, 15 min, 20 min, and 25 min had elapsed in each session. The results indicated that the first-engaged item and the 5-min high-allocation item predicted the top-ranked item in 55% and 62% of the sessions, respectively. The results also showed that engagement with the top-ranked item from the first session decreased across subsequent sessions for 6 of the 9 participants. The implications of the results for brief versus extended stimulus preference assessments are discussed.

Key words: extended assessment, free-operant stimulus preference assessment, multiple-stimulus without replacement, response allocation

Several studies have shown that free-operant multiple-stimulus preference assessments of brief duration (e.g., 5-min sessions) can identify stimuli that compete with problem behavior (e.g., Ringdahl, Vollmer, Marcus, & Roane, 1997) and function as reinforcers for arbitrary responses (e.g., Ortiz & Carr, 2000; Roane, Vollmer, Ringdahl, & Marcus, 1998). Although the identification of a reinforcer hierarchy was not necessarily the intended outcome of the free-operant multiple-stimulus assessment, a potential limitation to this approach is that participants may engage with only one or two items during a session. Thus, from a practical perspective, free-operant multiple-stimulus assessments may not provide data on a range of potential reinforcers to use in response acquisition and reduction programs (Hanley, Iwata, Lindberg, & Conners, 2003).

To address this problem, the multiple-stimulus without replacement (MSWO; DeLeon & Iwata, 1996) approach can be used, in which the first item selected by the participant is removed from an array after a brief period of access, response allocation to the remaining items is evaluated, and the process is repeated in a diminishing fashion to produce a hierarchy of preferred items. Ortiz and Carr (2000) found that free-operant multiple-stimulus and MSWO methods identified comparable reinforcers during brief assessments; however, researchers have yet to determine whether assessments that involve relatively brief (e.g., 5-min) access to items predict preference for those same items over an extended period of time. For example, it is not clear if the item that is first engaged with from an array will be manipulated for the highest percentage of time (i.e., be preferred) during a longer (e.g., 30-min) session.

Steinhilber and Johnson (2007) conducted two experiments to evaluate the effects of providing relatively brief or long periods of access to items for two individuals using the MSWO format. The results from the first experiment indicated that item preferences differed depending on whether access to the item was brief (15 s) or long (15 min). They also conducted a second experiment to determine which method identified items that functioned as reinforcers for completing math problems during a concurrent-chains procedure. The results of the second experiment showed that an item functioned as a reinforcer

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primarily under the condition in which it was identified as being preferred. That is, the participants chose the stimulus that was identified as preferred with the long-access assessment when the duration of access to the stimulus was long (15 min), but chose the stimulus that was identified with the short-access assessment when access time was brief (15 s). Thus, these results suggest that relative preference for a stimulus may be influenced by the duration for which the stimulus is available. Specifically, Steinhilber and Johnson suggested that brief assessments may not identify items accurately that are used ultimately as reinforcers for extended periods of time. The authors speculated that providing an individual 30 s to manipulate an item that requires 5 min of manipulation to generate a reinforcing consequence may function as an abolishing operation (AO) for that item as reinforcer.

The purpose of the present study was to evaluate the extent to which early response allocation (e.g., the first-engaged item) to items within free-operant multiple-stimulus preference assessments predicted the top-ranked item based on response allocation across 30-min preference assessments. Toward that end, this study endeavored to address two questions. First, to what extent are individuals' preferences, as identified at the conclusion of a preference assessment, consistent across repeated measurement using the same assessment method? If the top-ranked item (or the two or three top-ranked items) from an initial assessment remain top ranked across repeated assessments (i.e., between-sessions response allocation), it would suggest that the initial assessment identifies items for which individuals display relatively stable preference; this may obviate the need for frequent assessment updates. Second, does early response allocation (e.g., after initial contact or after 5 min) within an extended-length preference assessment predict the item that will be identified as the most preferred stimulus at the conclusion of the preference assessment (i.e., the item associated with the most response allocation during the entire session)?

METHOD

Participants and Setting

Nine individuals participated in this study. Danny, Norton, and Anne were 8, 11, and 5 years old, respectively, and each had been diagnosed with attention deficit hyperactivity disorder (ADHD). Chris and Jimmy were 9 and 11 years old, respectively, and both had been diagnosed with autism. Carl was 10 years old and had been diagnosed with an unspecified learning disability. Jane, Brad, and Amy were 6, 11, and 10 years old, respectively, and none had a formal diagnosis at the time of this study. Participants had been referred by their teachers for behavioral services based on their exhibition of problem behavior in school.

Free-operant multiple-stimulus preference assessments were conducted with each participant as one part of a multiphase preintervention assessment package. All sessions took place in rooms located in three public schools; all sessions for a given participant were conducted in the same room.

Data Collection

Observers used laptop computers to score the duration of engagement with each item and converted duration of engagement into a percentage-of-session measure for the purpose of data analysis by dividing the length of time in which a response was observed by the duration of the observation (e.g., 30 min). A second observer scored 100% of all sessions for Carl, Chris, and Danny; 66% of the sessions for Amy and Norton; 60% of the sessions for Anne; 50% of the sessions for Jimmy and Brad; and 33% of the sessions for Jane. Interobserver agreement was calculated for each participant's engagement with each item using the proportional method. Specifically, each session was partitioned into a series of successive 10-s blocks, and data that were collected by the primary and

secondary observers were compared on a block-by-block basis (see Mudford, Taylor, & Martin, 2009). For each block, the smaller number was divided by the larger number, and this ratio was converted to a percentage. Percentages for each block were totaled and divided by the total number of blocks. To avoid inflating agreement scores due to agreements on nonoccurrences, items were only included in the agreement calculation for a given session if one or both observers scored at least 10 s of engagement with the item. The therapist gave Jane and Chris access to six items, and the mean interobserver agreement scores across items were 95% (range, 86% to 100%) and 98% (range, 97% to 100%), respectively. The therapist gave Brad, Norton, and Jimmy access to seven items, and the mean agreement scores across items were 99% (range, 97% to 100%), 95% (range, 88% to 100%), and 99.5% (range, 99% to 100%), respectively. The therapist gave Anne and Amy access to eight items, and the mean agreement scores across items were 89% (range, 87% to 100%) and 95% (range, 87% to 100%), respectively. The therapist gave Carl and Danny access to 12 items, and the mean agreement scores across items were 98% (range, 96% to 100%) and 96% (range, 92% to 100%), respectively. Interobserver agreement scores were also calculated for identification of the first-engaged item, identification of the top-ranked item, and the order of selection (described below) for each session by scoring an exact agreement when both observers identified the same item in each category for a given session (e.g., Hagopian et al., 1997), dividing by the total number of sessions, and converting to a percentage. The agreement score for each of the three events was 100% across all participants.

Response Definitions and Procedure

Engagement with a specific item was defined as contact of either of the participant's hands with the item. Although it was possible for participants to manipulate more than one item simultaneously, they rarely did so for periods beyond 1 min (with the exception of Session 3 for Anne). Sessions were conducted in a manner similar to that described by Roane et al. (1998), with two exceptions. First, each session was programmed to be 30 min long. (Due to schedule conflicts, a 29-min session, a 28-min session, and a 27-min session were conducted with Danny, Jane, and Amy, respectively.) Second, sessions were conducted only once per day, 1 or 2 days per week, for a period of 2 to 12 weeks.

Items used in the assessment included figurines (action figures), dolls, computer games, squish balls, bounce balls, Moon Sand, TV games, remote-control cars, markers and paper, a Smart Board, a Nintendo, blocks, a toy truck, Lite Brite, and a small laptop computer. The items for each participant were selected from a pool of approximately 20 items based on (a) teacher reports of the participant's preferences, (b) informal observations of the participant's response allocation to certain types of toys or activities when in class, and (c) age appropriateness of the available toys (as suggested by the manufacturers). For each participant, the same 6 to 12 items were available in each free-operant session. The choice to include more or fewer items for each participant was based primarily on (a) the availability of items that were considered age appropriate for the participant and (b) whether the participant's teacher was willing to provide access to the item contingent on appropriate behavior in the classroom. At the request of the participant, games or puzzles were preserved at the end of each session so that he or she could resume the activity during the subsequent session; this practice was consistent with the procedures used by Steinhilber and Johnson (2007). Prior to the first session, engagement with each item was modeled by a graduate or undergraduate student, and the therapist provided brief access (e.g., 30 to 60 s) to the item to ensure the participant's familiarity with the items.

In addition to free-operant sessions, Jimmy and Brad participated in one or two restricted-operant multiple-stimulus sessions in which specific items were withheld, because each allocated his responding exclusively to a computer game during the first two sessions. Based on the guidelines described by Hanley et al. (2003), we restricted access to the computer game to determine whether either boy would manipulate other items in their respective arrays. That is, because their teachers could not provide access to the computer game for appropriate behavior each day (e.g., the game was licensed and available on only one computer to which several students had access), it was necessary to determine whether the participants preferred other items when the computer game was not available. We did not provide access to the items used in this assessment outside the experimental sessions; however, some items (e.g., markers and paper) that were similar to those used in the assessment were available to some of the participants at specific times nearly every day. Although we conducted several free-operant sessions with Carl and Chris, only the data from the first two sessions were included in this study because several of the high-preference items were used in their behavioral intervention programs following the second session.

Data Analysis

The item with which the most engagement occurred at the conclusion of each 30-min session was considered to be the top-ranked item. To evaluate the consistency of the top-ranked item across sessions, the top-ranked item from the first session was denoted the first-session (FS) top-ranked item, and the results of each free-operant assessment were analyzed to determine if the FS top-ranked item was the same as the top-ranked item in subsequent sessions.

To evaluate whether early response allocation within each session predicted the top-ranked item for that session, each session was analyzed to identify the item that was engaged with first, and the item to which the most time was allocated after 5 min, after 10 min, after 15 min, after 20 min, and after 25 min of the session elapsed. The first-engaged item provided a within-session measure that approximates the manner in which item selection is measured in a MSWO assessment (e.g., DeLeon & Iwata, 1996), and the 5-min high-allocation item is identical to the product of the brief free-operant assessment described by Roane et al. (1998).

To determine whether participants allocated their responding to the same items during each session, data on minute-by-minute engagement with the three highest ranked items (in terms of the percentage of engagement during the first 30-min session) were plotted across sessions (Vollmer, Iwata, Zarcone, Smith, & Mazeleski, 1993). Data from each session were also analyzed to determine (a) the latency (in seconds) from the start of each session to the participant's first contact with the item that eventually emerged as the top-ranked item and (b) the order in which the participant engaged with the top-ranked item (i.e., whether the participant engaged with other items before engaging with the top-ranked item). Finally, at the conclusion of each 30-min session, we calculated the mean percentage duration of interaction for each item by summing the percentage of interaction within each minute of the session and dividing this total by the length of the session and converting the ratio to a percentage.

RESULTS

Figures 1 through 3 depict the within-session outcomes for each participant's preference assessment. For each participant, the three items to which he or she allocated most time during the first 30-min session are depicted across all assessment sessions. Items that were ranked fourth or lower (based on the first session) were referred to collectively as low-ranked items and, due to space constraints, are not depicted in the

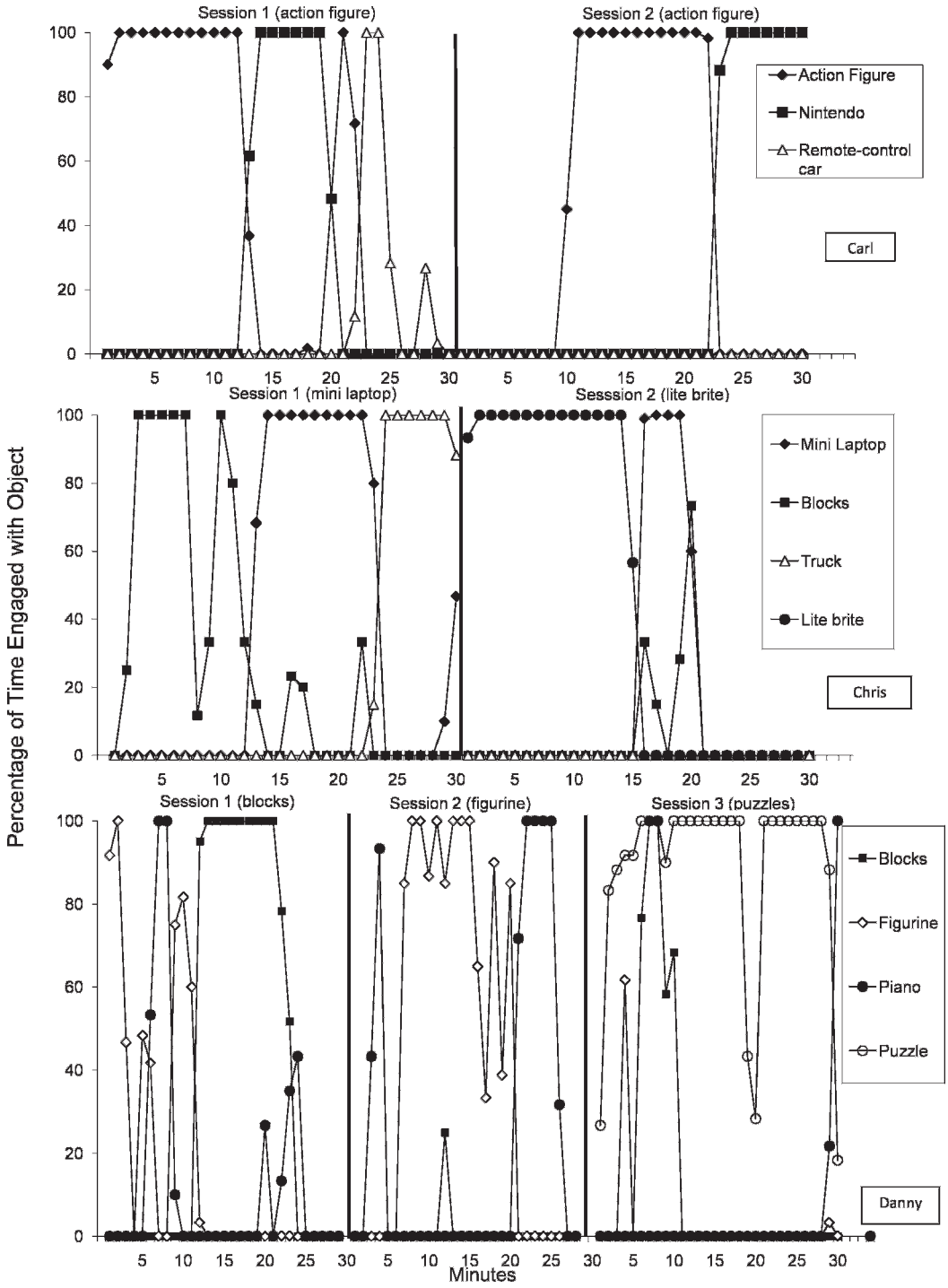

Figure 1. Percentage of time Carl (top), Chris (middle), and Danny (bottom) manipulated items during extended free-operant preference assessments. The top-ranked item for each session is listed in parentheses next to the respective session number.

figures (data on response allocation for all stimuli across all sessions are available from the first author). If one of the three highest ranked items from the first session was not the highest ranked item in a subsequent session, data from the highest ranked item for the respective session are also depicted in the figures.

Figure 1 shows the percentage of time that Carl, Chris, and Danny engaged with items during free-operant preference assessment sessions. During the first session, Carl engaged with the action figure consistently during Minutes 1 through 12 and then switched to the second-ranked item (Nintendo) during Minutes 13 through 19. During Minutes 20 through 30, he allocated his behavior to the remote-control car and various low-ranked items. Overall, the FS top-ranked item for Carl was the action figure (48.3% of session), followed by the Nintendo (23.7%) and the remote-control car (9%). During the second session, he engaged with various low-ranked items for Minutes 1 through 9. Although he did not engage with any of the three top-ranked items until Minute 10 of the second session, the FS top-ranked item (action figure) was again the top-ranked item at the conclusion of the second 30-min assessment (41.4%), and the Nintendo remained the second-ranked item (26.3%).

In contrast to Carl, Chris did not engage with the FS top-ranked item (small laptop computer, 36.8%) until Minute 13 of the first session and, instead, manipulated the blocks, which were ultimately the second-ranked item (29.2%). The truck (23.4%) was the third-ranked item. Similar to Carl, Chris did not engage with any of the three top-ranked items until Minute 15 of the second session but instead manipulated a previously low-ranked item (Lite Brite) for 48.3% of the second session. The small laptop (15.3%) and the blocks (5%) were the second- and third-ranked items, respectively, during the second session.

Similar to Chris, Danny allocated the first 10 min of the first session to the items that were ranked second (figurine, 18.9%) and third (piano, 13.2%) ultimately and did not contact the FS top-ranked item (blocks, 38.8%) until Minute 13. In the second session, he allocated the highest percentage of his time to the figurine (38.9%), but he allocated less than 1 min to the FS top-ranked item (blocks, 0.8%). Although the amount of time Danny engaged with the FS top-ranked item (blocks, 13.4%) was higher in the third session than in the second session, he manipulated a previously low-ranked item (puzzle) for 88% of the third session. He rarely interacted with the piano (4.1%) and the figurine (2.2%) in the third session.

Figure 2 shows the percentage of time that Amy, Norton, and Jane engaged with items during the free-operant assessment sessions. As before, the three items to which the most time was allocated during the first 30-min session are depicted across sessions for each participant. In the first session, Amy contacted the FS top-ranked item (dolls, 59.2%) during Minutes 1 through 22. The Smart Board (10.5%) and the TV games (7.8%) were the second- and third-ranked items. In the second session, Amy also contacted the FS top-ranked item (dolls) in Minute 1; however, she did not manipulate that item consistently until after Minute 20, and that item was also the top-ranked item in the second assessment (37%). Prior to that time, she allocated most of her responding to the second-ranked (Smart Board, 18.3%) and third-ranked (TV games, 10.8%) items. In the third session, as in the first session, Amy contacted the FS top-ranked item (dolls, 42.8%) in Minutes 1 through 16. Thereafter, she allocated the majority of her time to low-ranked items. Only the FS top-ranked item (dolls) was manipulated for five or more consecutive minutes in each session.

Norton allocated most of his behavior to a single item during each of the three sessions (Figure 2). In the first session, he engaged with the FS top-ranked item (the TV game, 66.7%)

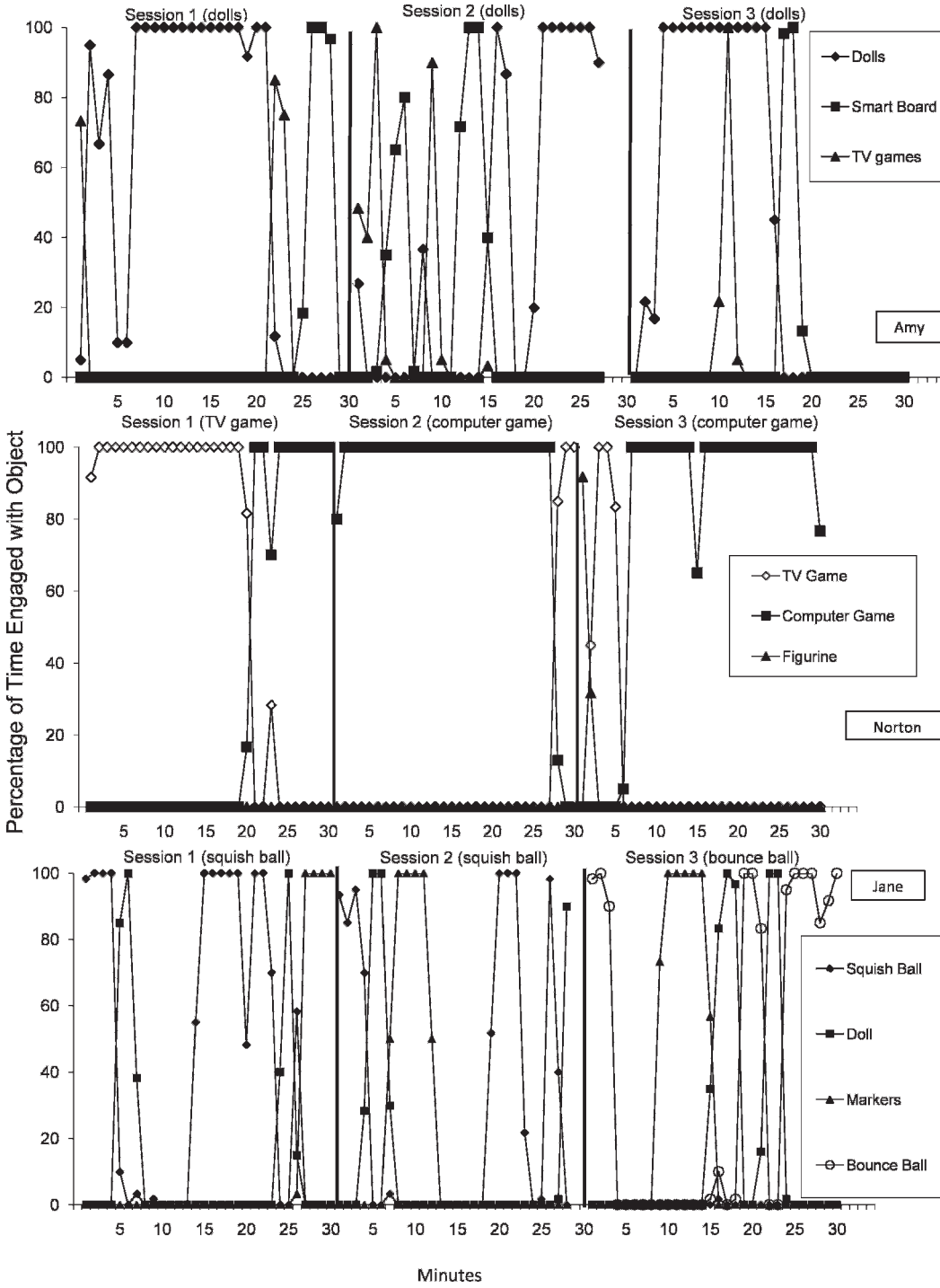

Figure 2. Percentage of time Amy (top), Norton (middle), and Jane (bottom) manipulated items during extended free-operant preference assessments. The top-ranked item for each session is listed in parentheses next to the respective session number.

from Minutes 1 though 20 and then shifted his responding to the computer game (32.9%) for the remaining 10 min. In the second session, the pattern was reversed such that he manipulated the computer game (89.8%) during Minutes 1 through 27 and the TV game (FS top-ranked item, 9.5%) during the last 3 min. In the third session, he allocated portions of the first 5 min to a previously low-ranked item (figurine, 4.1%) and the FS top-ranked item (TV game, 10.9%), but thereafter allocated most of his time to the computer game (78.2%).

In Jane's first session (Figure 2), she contacted the FS top-ranked item (squish ball, 44.8%) during Minute 1 and manipulated that item for just over 4 min. After manipulating low-ranked items for several minutes, Jane shifted her responding back to the FS top-ranked item until Minute 23, after which she manipulated the second-ranked (markers, 13.4%) and third-ranked (doll, 12.6%) items. In the second session, Jane's manipulation of the three highest ranked items was similar to that observed in the first session except that she shifted responding away from the FS top-ranked item following relatively brief interactions during Minute 1 and Minute 19. For the second session, the FS top-ranked item (squish ball, 30.7%) was again the top-ranked item. In the third session, Jane allocated her responding to low-ranked items from Minutes 1 through 8. Specifically, she first engaged with the top-ranked item (bounce ball, 41.9%) during Minute 1 and manipulated it for most of the session. She manipulated the FS top-ranked item (squish ball, 0.05%) only briefly during Minute 16.

Figure 3 shows the percentage of time Anne manipulated items during five free-operant assessment sessions. In the first session, she contacted the FS top-ranked item (Smart Board, 68.7%) during Minute 9 and thereafter allocated her time exclusively to that item. The small laptop (20.3%) and the figurine (2.9%) were the second- and third-ranked items. In the second session, Anne contacted the FS top-ranked item (Smart Board, 27.4%) during Minute 1; however, by Minute 9 she shifted to the second-ranked item (small laptop, 23.4%). During Minute 16, Anne shifted her responding to a previously low-ranked item (coloring book, 41.7%), which was ultimately the top-ranked item in the second session. She manipulated the FS third-ranked item (figurine, 0.6%) only briefly during the second session. In the third session, she manipulated the TV games, which were the top-ranked item, for 65.3% of the session; however, she also manipulated the FS top-ranked item (Smart Board, 32.8%), the second-ranked item (small laptop, 15.3%), and the third-ranked item (figurine, 0.8%) for periods of time that were comparable to the second session. In the fourth session, Anne initially manipulated the FS top-ranked item (Smart Board, 66.7%), and over the course of the session manipulated it and the second-ranked item (small laptop, 74.9%) item simultaneously, but ultimately she allocated more responding toward the small laptop (she did not manipulate the figurine in this session). In the fifth session, Anne again manipulated the FS second-ranked item (small laptop, 71.1%) for the most time followed by the FS top-ranked item (Smart Board, 24.8%) and the FS third-ranked item (figurine, 16.5%). As a whole, her preference for the top two items (based on the first session) was consistent across sessions.

Figure 3 shows the percentage of time that Jimmy and Brad manipulated items during free-operant and restricted-operant assessment sessions. As previously noted, Jimmy and Brad were exposed to restricted-operant conditions because each engaged in exclusive manipulation of the computer game during the first and second assessment sessions. When the computer game was restricted in the third session, Jimmy engaged with the Moon Sand (39.7%) for Minutes 1 through 12, but thereafter shifted his responding to the puzzle (58.4%) for the

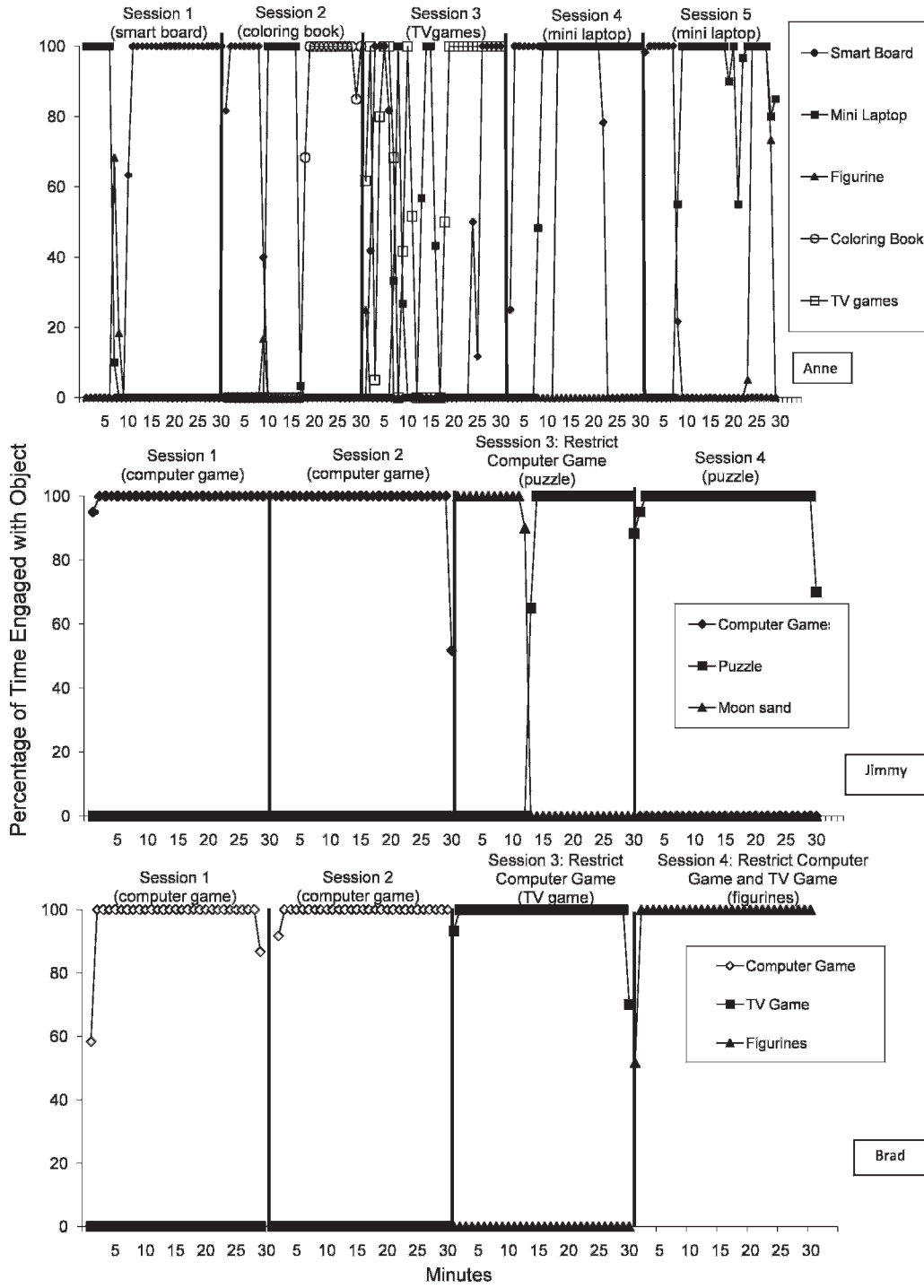

Figure 3. Percentage of time Anne (top) manipulated items during extended free-operant preference assessments. Percentage of time Jimmy (middle) and Brad (bottom) manipulated items during free-operant and restricted-operant preference assessments. The top-ranked item for each session is listed in parentheses below the respective session number.

Table 1
Response Allocation at Various Points of the 30-min Assessments

Participant	Same as FS top ranked	Same as the top-ranked item for the 30-min session (within each assessment session)							Mean latency to engagement with the top-ranked item for each assessment session
		First engaged	5 min	10 min	15 min	20 min	25 min	30 min	
Carl	1/1	1/2	1/2	1/2	1/2	2/2	2/2	2/2	290 s
Chris	0/1	1/2	1/2	1/2	1/2	1/2	2/2	2/2	372 s
Danny	0/2	1/3	1/3	1/3	3/3	3/3	3/3	3/3	304 s
Amy	2/2	0/3	2/3	2/3	2/3	2/3	3/3	3/3	64 s
Norton	0/2	2/3	2/3	2/3	3/3	3/3	3/3	3/3	124 s
Jane	1/2	3/3	3/3	1/3	1/3	1/3	3/3	3/3	2 s
Anne	0/4	1/5	1/5	1/5	2/5	3/5	3/5	5/5	500 s
Jimmy	1/2[a]	3/4[b]	3/4	3/4	3/4	3/4	4/4	4/4	187 s
Brad	2/2[c]	4/4[b]	4/4	4/4	4/4	4/4	4/4	4/4	31 s
Total	39%	55%	62%	55%	69%	76%	93%	100%	M = 213 s

[a] FS top-ranked item was restricted for one session.
[b] Exclusive or near-exclusive allocation to a single item during two or more sessions.
[c] FS top-ranked item was restricted for two session.

remainder of the session. Following a return to the free-operant condition (i.e., the computer game was available), he continued to allocate his responding to the puzzle (98.8%).

When the computer game was restricted in the third session for Brad, he allocated all of his responding to the TV game. When both the computer game and the TV game were restricted in the fourth session (for the same reason that the computer game was restricted in Session 3), Brad allocated his responding to the figurine. Thus, the results for Jimmy and Brad are similar insofar as restricting the top-ranked stimuli facilitated reallocation to previously low-ranked stimuli. Table 1 provides a summary of the results for each participant. The second column summarizes the between-sessions comparisons based on the FS top-ranked item for each participant. Specifically, it indicates whether the top-ranked item in each of the subsequent assessment sessions was the same as the FS top-ranked item (with the exception of those sessions for Jimmy and Brad when the FS top-ranked items were restricted). For example, there were three total sessions conducted for Jane. Following the first assessment, the top-ranked item was the same as that identified in the first session in one of the two subsequent sessions. By contrast, of the three sessions conducted for Danny, the top-ranked items in the second and third sessions never matched the top-ranked item from the first session.

The remaining columns of Table 1 indicate when the top-ranked item, which may or may not be the same as the FS top-ranked item, was identified during each session for each participant. More specifically, the third column indicates whether the first-engaged item was ultimately the top-ranked item for a given session, and the fourth through ninth columns indicate whether the item to which the participant allocated the most time at each interval (within each session) was ultimately the top-ranked item for a given session.

For example, based on response allocation during the first free-operant session, the second column shows that Amy engaged with the FS top-ranked item for the highest percentage of time in two of the two subsequent sessions. The third column shows that the top-ranked item (within each individual session) was not the first-engaged item in any of the three sessions (including the first session). The fourth, fifth, sixth, and seventh columns show that she manipulated the top-ranked item (within each session) for the highest percentage of time for two of the three sessions during the first 5 min,

10 min, 15 min, and 20 min, respectively. The eighth and ninth columns show that she manipulated the top-ranked item for the highest percentage of time for three of three sessions through the first 25 min and the full session (30 min), respectively. The 10th column shows that Amy contacted the top-ranked item after a mean of 64 s into each session.

Based on the cumulative data across all nine participants, the second column of Table 1 (bottom row) shows that allocation to the FS top-ranked item predicted the item to which the participants allocated the highest percentage of time (i.e., the preferred item) during 39% of the subsequent sessions. The third column shows that the item to which the most behavior was allocated during each session was predicted by the first-engaged item in 55% of the sessions. The fourth, fifth, sixth, seventh, and eighth columns show that the top-ranked item was predicted based on the item to which the participant allocated the most time during the first 5 min, 10 min, 15 min, 20 min, and 25 min within each session for 62%, 55%, 69%, 76%, and 93% of the total sessions, respectively. (Note that the decrease in response allocation from 5 to 10 min across participants was a function of Jane's results in two assessments during which she shifted response allocation from the top-ranked item during the 10-, 15-, and 20-min intervals and thereafter shifted back to the top-ranked item for the remainder of the session.) Likewise, the 10th column shows that participants made first contact with the top-ranked item after a mean of 213 s (range, 1 to 1,039 s) had elapsed in the session. As a whole, the participants typically engaged with the top-ranked item within each session after manipulating at least two other items (M = 2.2 items). In summary, the participants' top-ranked item (i.e., most preferred item) for each 30-min session was identified within 10 min for just over half of the sessions and within 20 min for just over two thirds of the sessions.

DISCUSSION

The results of this study can be interpreted with respect to within-session and between-sessions patterns of response allocation during extended preference assessments. The within-session patterns suggest that the first-engaged item (which is a measure of preference detection presented by DeLeon & Iwata, 1996) identified the top-ranked item during 55% of the sessions, whereas response allocation after the first 5 min of the session (i.e., the measure of preference described by Roane et al., 1998) identified the top-ranked item during 62% of sessions. If data from Anne's sessions were excluded from the analysis, both measures would have predicted the top-ranked item in 58% of the sessions. The best predictor of the top-ranked item during a 30-min session was the percentage of time participants allocated to the items during the first 25 min of the session; however, the top-ranked item for 30-min sessions was detected after 15 min for nearly 70% of the sessions across participants.

The results of the within-session analysis suggest that the first-engaged item may not be the top-ranked item over extended periods of time. This finding can be interpreted in at least three ways. First, some items may require less time to produce reinforcing stimulation than other items. In this way, the first-engaged item may be momentarily more reinforcing (i.e., a relative establishing operation [EO] is present) than the concurrently available items, but only a brief period of interaction or manipulation is necessary to produce an AO for the stimulation that is generated by manipulation of that item. Using an MSWO assessment, DeLeon, Iwata, and Roscoe (1997) found that individuals tended to select food items over activities; it is possible that there is a bias for choosing items that generate an immediate reinforcing event over items that require more extensive engagement to generate reinforcing stimulation, especially when relatively brief (e.g., 30 s) access to stimuli is provided. Second, consistent with

the findings of Steinhilber and Johnson (2007), a participant may have selected items as though he or she was provided only a brief period of access. In this way, participants may have selected items from which reinforcing stimulation could be derived in a relatively brief period of time. Third, it is possible that manipulating the first-engaged item may have set the occasion for engagement with a subsequent item to function as a more potent reinforcing event.

In terms of the consistency of individual's preferences across time (i.e., between sessions), the results indicated that (a) the FS top-ranked item predicted the top-ranked item in only 39% of the subsequent sessions, and (b) time allocation to the FS top-ranked item decreased across sessions for six of the nine participants (excluding the restriction sessions for Jimmy and Brad). Likewise, participants allocated increasingly more time to low-ranked stimuli as sessions progressed. Thus, a single 30-min session may not identify a single item for which all individuals display an enduring preference. In addition, the first-engaged item predicted the most preferred item for each 30-min session in just over half the sessions. One implication of these findings is that practitioners who use extended preference assessments may need to conduct frequent updates with extended sessions to identify individuals' preferences across time.

In regard to changes in preference for the FS top-ranked item across sessions, three response patterns were prominent. First, the FS top-ranked item remained the top-ranked item across each sessions for only three (Amy, Carl, and Brad) of the participants; however, these three individuals participated in a maximum of three free-operant sessions, and it is possible that their preferences may have changed with additional sessions. Despite this between-subjects variability, the FS top-ranked item from the first session remained one of the three highest ranked items across subsequent sessions for nearly every participant. Second, for three individuals (Jane, Chris, and Danny) who did not allocate the highest proportion of time to the FS top-ranked item across sessions consistently, the FS top-ranked item remained in the top three highest ranked items during each subsequent session. Third, three of the participants (Norton, Anne, and Brad) shifted responding away from the FS top-ranked item to items that generated overt stimulation that was comparable or matched to overt stimulation that was generated by the FS top-ranked item (cf. Piazza, Adelinis, Hanley, Goh, & Delia, 2000). For example, after Brad's access to the computer game (FS top-ranked item) was restricted in the third session, he reallocated nearly of all his responding to the TV game, which arguably produced stimulation that was comparable to and substituted for the stimulation generated by the computer game.

The first-engaged item, as well as the high-allocation item after 5 min, accurately predicted the top-ranked item for Brad and, to a lesser extent, Jimmy; however, both participants typically allocated their responding exclusively to one activity. Because Brad and Jimmy were two of the oldest participants in this study (both were 11 years old), it is possible that each had more extensive histories of reinforcement for choosing activities that provided ongoing stimulation. Although the first-engaged item and the high-allocation item after 5 min predicted the top-ranked item in each session for Jane, the high-allocation item after 10 min, 15 min, and 20 min did not. Unlike Brad and Jimmy, Jane manipulated the top-ranked item for the first half of each session and allocated responding to at least two other items during the second half of each session.

By contrast, the first-engaged item did not predict the top-ranked item reliably for Danny, Amy, or Anne; however, the 5-min and 15-min high-allocation items were better predictors of preference over the 30-min assessment for Amy and Danny, respectively. It is interesting to note that the first-engaged item was least accurate for

predicting the top-ranked item for the 30-min session for the three individuals who had access to the most items (12 for Danny and 8 for Amy and Anne). Thus, it is possible that the number of stimuli in the array influenced the participants' response allocation. The findings for the first-engaged item for Danny, Amy, and Anne are consistent with those reported by DeLeon et al. (2001), who found that top-ranked items that were identified initially via an extended paired-choice assessment did not reliably predict top-ranked items during brief, daily MSWO assessments.

Although the primary focus of this study was to evaluate response allocation during free-operant MS assessments, restricted-operant sessions were also conducted with two participants. For Jimmy, restriction of the FS top-ranked item produced exclusive responding to a different item. When the FS top-ranked item was reintroduced in the subsequent session, he continued to allocate his responding exclusively to the other item. This pattern was not expected, because studies that involve the restriction of high-probability automatically reinforced behavior have shown that response allocation to the restricted response often resumes or increases immediately when the behavior is no longer restricted (e.g., Rapp, Vollmer, Dozier, St. Peter, & Cotnoir, 2004). When Brad's FS top-ranked item was removed, he too allocated responding exclusively to another item. Thus, restricting the top-ranked item did not facilitate the development of a preference hierarchy within the session for either Jimmy or Brad; however, this finding should be interpreted with caution because the restriction analysis was not replicated with Brad.

The results of this study support and extend the findings of Steinhilber and Johnson (2007) by showing that brief (e.g., 5-min) multiple-stimulus assessments do not reliably predict response allocation during extended (e.g., 30-min) sessions. The results of the current study also provide additional support for the position that preference for the top-ranked items is not typically stable across time (i.e., the FS top-ranked item is not consistently top ranked). Finally, the results of this study are also consistent with results from Worsdell, Iwata, and Wallace (2002) and provide further evidence that extended free-operant assessments may be used to generate response or preference hierarchies for some individuals.

Some potential limitations to the results should also be noted. First, in the same manner that access to items for 5 min, 10 min, and 15 min did not perfectly predict individuals' preference for the 30-min period, it is possible that access to items for 30 min will not predict preference for lengthier periods of time (e.g., 60 min). It is unlikely that clinicians could conduct frequent updates of lengthier preference assessments; thus, other well-validated procedures that involve brief access to stimuli may be better suited for frequent application (e.g., DeLeon & Iwata, 1996).

Another potential limitation of the current study was that the amount of time between sessions was not controlled. This variability is a problem because other studies have found that extended access to items may alter subsequent preference (e.g., Hanley, Iwata, & Roscoe, 2006). Third, the number of sessions varied across participants. The extent to which the FS top-ranked item predicted preference in subsequent sessions could have been evaluated more extensively if sessions were conducted over longer and more consistent periods of time (e.g., every week for 3 months).

Prior studies have shown that stimulation from preferred items can compete with social reinforcement for response allocation (e.g., Hanley, Piazza, & Fisher, 1997), and future research should evaluate the extent to which items identified via brief or extended analyses differentially compete with social and nonsocial reinforcers. Similarly, it is interesting to note that the FS top-ranked item did not predict the top-ranked item in subsequent sessions for the

three participants with ADHD. Future research should evaluate the extent to which behavior allocation within and between brief and extended preference assessments may be used to evaluate behavior that is indicative of ADHD. It may also be useful to replicate this analysis with individuals who are diagnosed with developmental disabilities.

Finally, with the exception of the Steinhilber and Johnson (2007) study, there is little basis in the literature for linking preference assessment access to reinforcer duration. Future research should further evaluate whether the amount of time that is provided to access a stimulus alters preference for that item and whether the item functions as a reinforcer for appropriate behavior. Similarly, there are no clear guidelines for determining when to terminate a free-operant preference assessment. Future research should examine the extent to which changes in the manipulation of items across extended assessments predict changes in the reinforcing value of the items within the array.

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