Do Persons with Intellectual and Developmental Disabilities Prefer to Save the Best for Last in an MSWO? A Preliminary Investigation

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Abstract

The multiple stimulus without replacement (MSWO; DeLeon & Iwata, 1996) preference assessment is commonly used to identify potential reinforcers. In this arrangement, individuals can choose the order in which they consume edibles or activities. The item selected first is often designated the highest preferred, and the item selected last is often designated the least preferred. Scattered reports suggest that some individuals may save the best for last in an MSWO. Despite these reports, few systematic evaluations of "saving the best for last" in the MSWO have been conducted. We examined this phenomenon using an MSWO and progressive-ratio-reinforcer assessment. Evidence of "saving the best for last" was obtained for one of four individuals across assessments involving edibles and leisure activities, respectively.

Keywords: MSWO, save the best for last, preference for sequences, negative time preference, individuals with intellectual and developmental disabilities.

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Recommending the least intrusive procedure is an ethical principle of applied behavior analysis (Behavior Analyst Certification Board®, 2020). This requires identifying effective reinforcers that can be incorporated into behavioral interventions. Stimulus preference assessments are tools to identify preferred items that may function as reinforcers in behavioral interventions for skill acquisition or the reduction of challenging behavior. One method for identifying a preference hierarchy is the multiple-stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996). Unlike some other stimulus preference assessments, the MSWO involves presenting an array of items to the individual at once. At the conclusion of the assessment, the item selected first has the highest selection percentage and is therefore the highest ranked item, and presumably the most preferred.

Implicit in the scoring of the MSWO is an assumption of positive time preference. In economics, the term *positive time preference* (Olson & Bailey, 1981) refers to a general preference for immediacy. When given a choice, humans generally prefer tangible or monetary rewards sooner rather than later (Loewenstein, 1987; Odum, 2011). Positive time preference (i.e., a preference for immediacy, or conversely, aversion to delays) is supported by the extensive research on temporal discounting, which has studied hypothetical choices of various consumable or material commodities, such as money (Bialaszek et al., 2019), food (Friedel et al., 2014), and legal (Bickel et al., 1999) and illegal (Madden et al., 1999) substances. Simply put, this extensive research on temporal or delay discounting (for a review, see Odum et al., 2020), has shown that in choice paradigms where only one outcome is selected from the array, delayed outcomes are generally valued less than immediate outcomes (Ainslie, 1975).

Nevertheless, there are reports to suggest that at times, individuals selecting items in an MSWO may be saving the best for last (Soldberg et al., 2007). Similarly, Call et al. (2012) found that one individual (Cameron), had contradictory preferences when comparing a paired stimulus preference assessment (PSPA) and MSWO. The item ranked first in the PSPA was ranked last in the MSWO. A subsequent reinforcer assessment indicated this item was a powerful reinforcer, seeming to indicate that Cameron saved his favorite item for last in the MSWO.

In a recent study, Fritz et al. (2020) evaluated the validity of the MSWO results by comparing items identified as most and least preferred by the MSWO in a concurrent-schedules format. In the studies involving neurotypical adults (Studies 1-3), the stimulus selected during the highest percentage of opportunities in the MSWO was not selected during the highest percentage of trials in the concurrent-schedules assessment for 20% to 30% of participants. The authors concluded that these response patterns could be attributed to a variety of idiosyncratic variables, including self-generated rules or "self-control responses" (e.g., save the best for last), the presence of complementary reinforcers (e.g., sweet, and salty), or the influence of motivating operations on subsequent selections. Perhaps more relevant to clinical practice, in Experiment 2, Fritz et al. evaluated the validity of the results of the MSWO with children and adults with intellectual and developmental disabilities (IDD). The results of the MSWO did not correspond with the concurrent schedule results for 4 of the 20 participants (20% of participants). Moreover, standardized assessments and anecdotal evidence in the form of self-report provided support for the hypothesis that one participant (Vanessa) was likely saving the best for last. It is possible, however, that if participant choice was under the control of self-generated rules in the MSWO, choice in a concurrent-schedules arrangement that consisted of a single session of 10 consecutive trials may have also been under the control of self-generated rules. Perhaps a comparative

assessment that does not involve selecting among two or more concurrently available items would facilitate the identification of high or low-preferred items, by eliminating the opportunity for self-generated rules involving choice among concurrently available items. Finally, Fritz et al. did not conduct reinforcer assessments following the MSWO and concurrent-schedules assessments. As the authors concluded, to further investigate the validity of the results of the MSWO particularly if some participants may be saving the best for last, further research should be conducted to examine the effectiveness of the items selected first and last in the MSWO as reinforcers in clinical applications.

Saving the best for last is an example of *negative time preference*, a term used in economics to refer to a general preference for improvement (Loewenstein & Prelec, 1991), or the idea that a series of improving circumstances may be preferable to a series of worsening events (i.e., going from higher- to lower-preferred). In a brief survey, Loewenstein and Prelec (1991) asked college students to choose between dinner at their highest preferred restaurant in one month or in two months. The majority (80%) selected the sooner option, exhibiting positive time preference. When the participants were later given the choice of scheduling two dinners: one at a moderately preferred restaurant and one at a more preferred restaurant, 57% of participants elected to experience the moderately preferred meal in one month and the more preferred meal in two months (i.e., they exhibited negative time preference; Loewenstein & Prelec, 1991). In other words, participants chose to delay a *more* preferred outcome when the choice was framed as a sequence. These general findings were replicated more recently (Castillo, Sun, Frank-Crawford, and Borrero, in press).

In an applied study, among a small sample of children who exhibit food selectivity, Borrero et al. (2021) recently demonstrated that 1 of 4 children exhibited a negative time

preference—in this case, a preference to start with the least preferred food and progress to the most preferred food. It is possible that the MSWO arrangement might be perceived as an opportunity to select the order in which a sequence of outcomes is experienced. If individuals exhibit negative time preference and choose to save the best for last in an MSWO, and practitioners implement the MSWO scoring as outlined in the literature, practitioners will not identify the highest preferred item. This can be a problem because if the individual saves the best for last, the item which would presumably be the most effective reinforcer is not likely to be included in subsequent behavioral interventions. Here, we present a proof-of-phenomenon study, in which we aim to determine whether saving the best for last is something that warrants further consideration, and to corroborate aspects of the findings reported by Fritz et al. (2020).

One reason that research on saving the best for last in an MSWO has been scarce to this date is that the prevalence of this phenomenon may be masked by publication bias (Tincani & Travers, 2019). It is possible that researchers may switch to a different assessment method (e.g., paired-stimulus preference assessment) if participant responding does not conform to what is expected in an MSWO (e.g., limited engagement with the item selected first, or more engagement with items selected later in the MSWO). Then, when published, the final manuscript may only reflect the outcomes from the "effective" preference assessment. Alternatively, the phenomenon may be unclear because researchers or practitioners do not become aware that saving the best for last has occurred until the stimulus is incorporated into a behavioral intervention, and the intervention is unsuccessful. There are at least four known publications in which one (Hangen et al., 2020; Soldberg et al., 2007) or more (Fritz et al., 2020) participants were explicitly noted or suspected (see Cameron's data in Call et al. 2012) to save the best for last, all other reports come from conference proceedings (Becerra & Fahmie, 2014; Litchmore et

al., 2014; Ngur et al., 2018; Pendharkar et al., 2017; Roath & Fritz, 2015), anecdotal reports, or our own clinical practice. Given the limited published evidence of "saving the best for last" in an MSWO, we sought to add to this literature by searching for evidence of its existence in a relatively small sample and, importantly, by determining whether it has any meaningful impact on the identification of the most effective reinforcers.

As such, the purpose of this study was to determine whether some individuals with IDD would save their most preferred item for last in an MSWO preference assessment. Following the MSWO, items selected first and last were then assessed under progressive ratio schedules to determine reinforcer efficacy.

Method

Participants and Setting

Three children and two adolescents were recruited from two different schools for children with developmental disabilities. In each school, members of the study team who were also school personnel identified one classroom of students with moderate to high verbal ability and contacted the parents of all students to provide information about the study and the consent form. The first five consecutive participants for whom consent was given were enrolled into the study. All study procedures were reviewed and approved by the first author's university institutional review board. All participants could independently scan arrays and spoke in full sentences. Jackson was 9 years and 10 months old at the start of the study and had a diagnosis of autism spectrum disorder (ASD). David was 15 years and 3 months and was diagnosed with ASD and epilepsy. Connor was 9 years and 7 months old and was diagnosed with Smith–Magenis syndrome. Laura was 9 years and 11 months old at the start of the study and had a diagnosis of ASD. Carlos was 12 years and 6 months and diagnosed with ASD and attention deficit hyperactive disorder. For

Carlos, we assessed multiple free operant tasks and he worked continuously for multiple 30-min no-reinforcement baseline sessions, even when reminded that he did not have to complete the work. Therefore, his participation was discontinued because conditions in which he would not complete tasks could not be identified. Thus, only the four participants who completed the entire study will be discussed hereafter. Results of the receptive language measure, the Peabody Picture Vocabulary Test, fourth edition (PPVT-4; Dunn & Dunn, 2007), are depicted in Table 1. Sessions were conducted by the research team in a quiet room in the school, such as an office or staff lounge, furnished with two chairs and a table.

Procedures

All participants completed a delay sensitivity assessment (e.g., Leon et al., 2016), followed by preference and reinforcer assessments with edibles and leisure items, separately. The order of the preference assessments was randomized across participants such that two participants completed the assessments with edibles first (Jackson and Connor), and two participants completed them with leisure items first (David and Laura).

Delay sensitivity assessment. The purpose of the brief delay sensitivity assessment was to determine whether participants preferred an immediate outcome (i.e., exhibit positive time preference), when given the choice between receiving a reward immediately, or the same reward following a delay. Specifically, using an item identified by the caregivers as highly preferred, the experimenter told the participant: "We have a [preferred item] for you. Do you want this [preferred item] now or later, in about 3 minutes?" If the participant selected "now," the item was delivered immediately. If the participant selected "later" the experimenter started a 3-min timer and said "OK, you chose in 3 minutes. You can have your [preferred item] when the timer beeps." When the 3-min timer elapsed, the experimenter delivered the item to the participant.

The procedure was repeated two more times, for a total of three trials.

Given the research on positive time preference and delay discounting, we expected participants to always prefer the immediate option, over an identical but delayed alternative. Furthermore, selecting the immediate alternative in the delay sensitivity assessment (when only a single outcome is experienced), while selecting the highest preferred item last in the MSWO (when all outcomes in the array are experienced), provides support for Loewenstein and Prelec's (1991) hypothesis that negative time preference is exhibited when the choice is viewed as a sequence.

MSWO preference assessments. Separate MSWOs were conducted for edible and leisure items. Participants' parents, teachers, or both were informally interviewed to identify five edibles and five leisure items to use in the MSWO. Dietary restrictions were honored, while also providing as much variety as possible (e.g., chocolate, salty, sweet, crunchy, gummy). Teachers were informed of the items selected for the assessment, and requested to restrict access to those items, however this was not formally controlled, and it is possible that participants may have had access to the items outside of the experimental sessions. The MSWO preference assessment was completed as described by DeLeon and Iwata (1996), and a minimum of three sessions were conducted (Richman et al., 2016). To account for changes in responding due to learning or exposure to the MSWO procedures, sessions continued until the items ranked first and last according to the mean of all sessions matched the items ranked first and last in the last session or until five sessions were conducted, as originally suggested (DeLeon & Iwata, 1996). In the MSWO, all stimuli were evenly spaced on the table in a horizontal array. Prior to each trial, the experimenter established eye contact with the participant and prompted the participant to orient to all stimuli ("[name], look") by making a sweeping gesture from one end of the array to the

other. The experimenter then verbally prompted the participant to "pick one". The selected item was delivered immediately following selection. Leisure items were delivered for 30 s or a single bite of food was provided until it was consumed. After the access period elapsed, or the participant finished consuming the edible, the selected item was either removed from the immediate area (leisure item) or not replaced (edible) and the remaining items represented. There was never an attempt to select more than one stimulus per trial. Between trials, the sequencing of the remaining items was rotated by taking the item from the left side of the array and moving it to the right end, then shifting the other items so that they were again equally spaced on the table. These steps were repeated until all stimuli were selected, or no stimulus was selected within 30 s from the beginning of a trial.

Overall ranks were determined by adding the number of times each item was available and assigning the highest rank (1) to the item with the lowest sum (see also Karsten et al., 2011). Although percentage of selection is commonly used to determine ranks in the MSWO, using sum of ranks to determine overall ranks seemed more appropriate given the experimenters' interest in ordinal selection, and these two measures are highly correlated. The items with the highest and lowest overall rank were selected for the reinforcer assessment.

Reinforcer assessments. Teachers were asked to nominate mastered tasks that the participants could complete accurately and independently (i.e., in a free-operant manner), but were not likely to do in the absence of reinforcement. Jackson and Connor traced letters, and David did single-digit addition and subtraction. Laura did simple addition in the first assessment (leisure items), but given the low levels of responding, switched to tracing letters for the second assessment (edibles). To ensure that engaging in the task was not inherently reinforcing, a brief no-reinforcement baseline was conducted first. Specific task materials were created for the

experimental sessions; however, participants may have had access to similar tasks in their regular programing. The stimuli ranked highest and lowest in the MSWO were evaluated as reinforcers under progressive ratio (PR) schedules presented in single-operant arrangements. As stated previously, teachers were asked to restrict access to those items, however, it is possible that participants may have had access to the items outside of the experimental sessions, as this was outside of the experimenters' control. Across both Baseline and Reinforcement phases, sessions were terminated immediately following the first instance of any of these criteria: (a) a 1-min period without a target response, (b) a withdrawal of assent from the participant (i.e., a request to stop that could be either vocal, or pointing to a picture of a stop sign that was placed at the side of the table), or (c) 30 min of session time (Tiger et al., 2010).

Baseline. At least three baseline sessions were conducted. Session duration varied based on participants' performance. Prior to initiating a session, participants were prompted (least-to-most prompting) to complete one task. None of the participants ever required the physical prompt to complete a task. No consequences were provided following completion. The following instructions were provided: "When you [engage in the target response], you will not get anything. You can [emit the target response] if you want to, but you don't have to. If you ever want to stop the session you can tell me or hand me this stop sign." Participants were not prompted to complete the task. If the participant engaged in problem behavior or emotional responses (e.g., crying or screaming) at any point during the session, the experimenter repeated the session instructions.

Reinforcement. Three PR sessions, at minimum, were conducted with each stimulus (items with highest and lowest rank in the MSWO). Reinforcement sessions were conducted in a multielement design, alternating stimuli across sessions in a randomized order. Session duration

varied based on participants' performance. Only one PR session was conducted per meeting. Meetings were conducted once or twice per day, with at least a 1-hr break in between meetings. The reinforcement sessions with a given stimulus were terminated when responding met stability with that item, defined as three consecutive sessions in which the number of schedules completed did not differ by more than three and there was no observable trend in the data, or when a maximum of six reinforcement sessions were conducted per stimulus.

Prior to initiating a session, participants were prompted to complete the task (guided exposure, according to the smallest schedule requirement). Although least-to-most prompting was used at this time, none of the participants ever required the physical prompt to complete a task during the guided exposure. The session-specific stimulus was provided following completion of the schedule requirement. Following guided exposure, the session instructions were provided: "When you [engage in the target response], you will get [specific stimulus]. You can [emit the target response] if you want to, but you don't have to. If you ever want to stop the session you can tell me or hand me this stop sign." Participants were not prompted to complete the task. The session-specific stimulus was delivered following completion of the pre-specified schedule requirement. The number of responses required to produce a reinforcer increased throughout each session according to an arithmetic progression with an addition of a fixed number of responses. That is, following each reinforcer delivery, the response requirement to produce the next reinforcer was increased by a constant number (e.g., first 1 response is required to earn a reinforcer, then 3, then 5, then 7, and so on) until one of the stop criteria was reached. The general rule for establishing the starting response requirement (SRR) was the smallest number (greater than zero) of total responses completed in baseline sessions, rounded down to a number that would be "convenient" for the PR sessions with a step size of 2 (e.g., if 3 responses

were completed in the baseline session with fewest responses, then the starting FR during reinforcement could be rounded to FR 2). The PR step size was set to 2 (i.e., PR 2) for most participants. For participants whose mean number of responses completed in baseline was greater than 20, the SRR was set to 5, with a PR step size of 5 (i.e., PR 5). Jackson's response requirement was set to SRR 1, PR 2. David's response requirement was set to SRR 2, PR 2. Connor's response requirement was set to SRR 5, PR 5. In general, the starting ratio and step size were kept constant across assessments (i.e., whatever was established in the first assessment, would be used in the second assessment for the same participant). For Laura only, the response requirements differed across assessments, due to performance, described below, which lead to a change in task. Specifically, it was set to SRR 1, PR1 during the assessment of leisure items, and SRR 5, PR 5 during the assessment of edibles.

Data Collection and Interobserver Agreement

Observers used paper data sheets to record the order in which each item was selected during the MSWO. Interobserver agreement (IOA) was calculated for each trial, and total agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements across all trials. Except for David's and Connor's MSWO of edibles items, for which 50% and 60% of trials had IOA, all other MSWOs had IOA calculated for all trials. There was 100% agreement on the order each item was selected in all trials scored by two observers.

During the reinforcer assessments, the observers collected data on task completion, whether the participant completed the schedule requirement, reinforcer delivery, and which session termination criterion applied. A second observer independently collected data during 69% (Jackson), 51% (David), 71% (Connor), and 74% (Laura) of sessions, with a minimum of

33% (Jackson), 25% (David), 25% (Connor), and 50% (Laura) in each condition and phase. For baseline task completion, schedule requirement and reinforcer deliveries, total count IOA was calculated by dividing the smaller number of responses by the larger number of responses for each session (Reed & Azulay, 2011). These fractions were averaged across all sessions with two observers to obtain the percentage of agreement. Unlike baseline sessions, in which there was no clear way to divide sessions into trials (because it was a free operant task and there was no prompting), it was possible to break down reinforcement sessions into "trials" using the different schedule values. Therefore, a more stringent measure of IOA was used for the reinforcement phase. Specifically, for task completion during reinforcement, trial-by-trial IOA was calculated by counting the number of schedule values for which there was agreement in the number of responses completed and dividing the number of agreements by the number of agreements plus disagreements (Reed & Azulay, 2011). For session termination criteria, exact agreement was used to determine IOA. Mean total count IOA for task completion in baseline was 99% (range, 93% – 100%) for Connor, and 100% for Jackson, David, and Laura. Mean trial-by-trial IOA for task completion in reinforcement was 97% (range, 87% – 100%) for Jackson, 97% (range, 86% – 100%) for Connor, and 100% for David and Laura. Perfect agreement (100% IOA) was obtained for all participants in all other measures, including the procedural integrity measures (i.e., reinforcer deliveries and session termination criteria).

Results

During the delay sensitivity assessment, all participants chose to receive the item immediately, rather than after 3 min. In other words, when given the choice between receiving a reward immediately, or the same reward following a delay, participants preferred the immediate

outcome, exhibiting *positive time preference* (i.e., preference for present over future consumption, when they choice involved a single outcome prospect; Olson & Bailey, 1981).

Results of the MSWO preference assessments are depicted in Table 2. The items ranked first and last were selected for the reinforcer assessments. David never selected Twix and Laura never selected Graham Bunnies in the MSWO, therefore, the items they *selected* last, ranked #4 (i.e., Goldfish and PopChips, respectively), were included in their reinforcer assessments. Results of the reinforcer assessments are presented next with discussion commensurate with the clarity of the outcomes. For each figure, the assessments are presented in the order they were conducted (i.e., assessment conducted first is in the top panel, second assessment is in the bottom panel). For the break point analysis, the experimenters used the data for the last three sessions to calculate the mean break point for each stimulus, given the established stability criteria (i.e., three consecutive sessions in which the number of schedules completed for a given stimulus did not differ by more than three and there was no observable trend in the data). Results will be described in terms of overall findings, first for Jackson, and then for the remaining 3 participants.

Results of Jackson's reinforcer assessments are depicted in Figure 1. Relative to baseline, the number of responses completed per session (leftmost panels) increased when the stimulus ranked last was used as a reinforcer, and initially increased, but then dropped, when the stimulus ranked first was used as a reinforcer. The break point analysis (rightmost panels) affirms these findings in that the stimulus Jackson selected last in the MSWO had a higher break point, than the stimulus he selected first. Similar response patterns were observed in the assessment of edibles (top panels) and leisure items (bottom panels).

Results of David's reinforcer assessment are depicted in Figure 2. In the first assessment (top left panel), relative to baseline, responding increased during reinforcement, with a slightly

higher number of responses completed per session, on average, when the stimulus ranked first was used as a reinforcer ($M = 49$), than when the stimulus ranked last was used as a reinforcer ($M = 46$). Mean break point (right panel) for the stimulus selected last in the MSWO was slightly higher ($M = 15$), than the mean break point for the stimulus selected first ($M = 11$). Results of Connor's reinforcer assessments are depicted in Figure 3. In the first assessment (top left panel), responding increased during reinforcement, responding was relatively higher for stimulus ranked first. Mean break point (top right panel) for the stimulus Connor selected first in the MSWO was slightly higher ($M = 28$), than that of the stimulus he selected last ($M = 27$). Results of Laura's reinforcer assessments are depicted in Figure 4. In the first assessment (top left panel), the task was completing simple addition. She completed very few responses in baseline ($M = 2$). The number of responses completed increased in the first reinforcement session with each stimulus, but then dropped precipitously. After three sessions with each stimulus, the duration of access to the reinforcer was increased from 30 s to 2 min to make task completion more reinforcing, but responding did not increase in the next session, therefore the PR step size was decreased to 1. Responding remained low with both stimuli. Although neither stimulus appeared to function as a reinforcer in this assessment, mean break point (top right panel) for the stimulus Laura selected first in the MSWO was slightly higher ($M = 2$), than that of the stimulus she selected last ($M = 1$). Given the limited responding in the first assessment, the task for the reinforcer assessment of edibles (bottom panel) was changed to tracing letters, a reportedly less effortful task. In the second assessment completed by David, Connor, and Laura (bottom panels of Figures 2, 3, and 4), they emitted more responses for the items selected first in the MSWO.

Discussion

In our sample, one in four participants (Jackson) responded more for the item selected

last, than for the item selected first, in both assessments (edibles and leisure items). These results suggest that Jackson was saving the best for last in the MSWO, even after exhibiting positive time preference in the delay sensitivity assessment. The other three participants responded more in one of the assessments (i.e., David's edible, Connor's leisure, and Laura's edible) for the item selected first, than the item selected last in the MSWO. Little to no difference was observed in the mean responding in the other assessment (leisure, edibles, and leisure) for David, Connor, and Laura.

There were some challenges in interpreting the data from three reinforcer assessments, due to variability (i.e., David's leisure and Connor's edible) or low levels of responding (i.e., Laura's leisure). Toward the end of the assessment, David responded more for the leisure item that he selected last than for that which he selected first. Given the variability in David's responding during the assessment, the degree of overlap between both data paths, and the days to completion of the assessment, it is possible that the item he selected last gradually became more preferred throughout the assessment. Furthermore, David's reinforcer assessment took a substantially greater amount of time to complete than did the same assessments for other participants (see Table 3), due to pauses in data collection and school breaks. Thus, a possible explanation for the difference in mean break points is that David's preference shifted during the assessment. Specifically, the item selected last in the MSWO (i.e., the rubix cube) may have become more preferred throughout the assessment, than it was initially. In Connor's case, the difference in mean break points for each edible was not meaningful enough to consider the item selected first as more effective than the item he selected last. We propose two alternative explanations that could account for his data. First, it is possible that Connor liked all the food in the MSWO, and he was simply asked to make difficult decisions regarding the order in which to

select them. This is supported by the fact that his responding was variable in the MSWO, and the maximum number of MSWO sessions had to be conducted. Second, it is possible that given the high step size (5), our assessment was not sensitive enough to demonstrate the differences in reinforcer efficacy. Regarding Laura's reinforcer assessment of leisure items, despite the overall low levels of responding, Laura did respond more for the leisure item she selected first, than she did for the one she selected last. Nonetheless, the increase in responding relative to baseline was minimal, for the item that produced an increase (i.e., the item selected first). This might be due to the difficulty of the task, and the amount of effort it required. Had a simpler task been used, such as the one used subsequently when assessing edibles, it is possible that responding would have increased to greater levels. Furthermore, the change in tasks across Laura's reinforcer assessments does not allow for clear comparison of effects across stimulus class. It is unclear whether the differences between these two assessments are due to the difference in stimulus type or the difference in task.

In Figures 2 – 4, the second assessment for David, Connor, and Laura always resulted in more differentiated levels of responding than the first assessment regardless of whether it was food or leisure. Restricting the number of sessions to six per stimulus limited our ability to continue the assessment to allow us to see a difference emerge. Perhaps continuing until stability, regardless of the number of sessions required, would have allowed us to make stronger conclusions about the differential effectiveness of the reinforcers, or difference across stimulus classes (food or leisure).

Although we requested that the edible and leisure items be restricted outside of the experimental sessions, we did not have control over, nor were we aware of, what the teachers and caregivers did when our participants were not involved in experimental sessions. Therefore,

it is possible that items could have been available to participants outside of session, and this, in turn, could have shifted preference by influencing the items' reinforcing effects through satiation and deprivation. Though this illustrates a lack of control over an essential feature of our independent variable it reflects an unavoidable sacrifice of conducting research in schools.

The present demonstration is limited by the absence of return to baseline, and the omission of a control condition in the multielement phase of the reinforcer assessment. Therefore, when patterns of responding were similar and overlapping across first and last reinforcement conditions, one cannot conclusively determine whether these items were both reinforcers, if the task became automatically reinforcing, or something else. Furthermore, the MSWO was not repeated following the reinforcer assessment. Replicating the MSWO would have helped inform whether participants were saving the best for last, or if their preferences had indeed shifted during the reinforcer assessment. Another limitation of the current study is that we conducted neither a rule-governed behavior assessment nor a self-control assessment, as described by Fritz et al. (2020). Thus, alternative explanations for the lack of correspondence between MSWO and reinforcer assessment results must still be considered. For example, the presence of complimentary reinforcers or influence of motivating operations on subsequent selections.

Of note is that all participants in the current study had intellectual disabilities and relatively moderate verbal ability (i.e., although their standard score on the receptive language measure was moderately low, they spoke in full sentences). Because research on "saving the best for last" in the MSWO is limited, at this point we do not know how often this phenomenon occurs, or what variables might contribute to it. It is possible that the phenomenon might be more likely among members of a specific population, such as those with more sophisticated language

ability. Studies involving concurrent-choice arrangements have suggested that there are complex interactions between experimental contingencies, the participants' verbal behavior, and participants' performance (Harzem et al., 1978; Horne & Lowe, 1993). In other research, language ability has been positively associated with delay of gratification among impulsive children (Rodriguez et al., 1989), and receptive language has been positively associated with delay of gratification by children with Down syndrome (Cuskelly et al., 2016). Psychologists have theorized that language skills may enable executive control and meta-cognitive processing by facilitating self-reflection, response inhibition, and behavioral direction (Gallagher, 1999). Although self-control as measured in the cited research is not equivalent to preference for improving sequences, it is still possible that language ability is also related to an individual's choice to save the best for last in an MSWO preference assessment.

It is unclear why Jackson was the only one who saved the best for last. Although all participants in our sample were highly verbal and spoke in full sentences, Jackson had the highest score in a receptive language test, even if the range in scores was relatively small (see Table 1). As suggested by Fritz et a. (2020), it is possible that self-generated rules or self-control responses may account for these response patterns. For example, in another study (Castillo, Sun, Frank-Crawford, Rooker et al., in press), a preschooler chose the preferred item following the delay in the delay sensitivity assessment, while clarifying "because my mommy said I have to wait."

In terms of differential responding according to stimulus class, all participants had relatively stable preference hierarchies in the MSWO of leisure items. In fact, only three sessions of the MSWO of leisure were needed for all participants. For the assessment of edibles, however, Jackson had the most stable preference hierarchy, requiring only three sessions. Preference

hierarchies for the other three participants were less stable, with David requiring four, and Connor and Laura five sessions each of the MSWO of edibles. More research comparing performance across stimulus class could help determine whether saving the best for last is more likely depending on the type of stimulus being assessed.

Future studies could be conducted to further determine participant characteristics that may predict the likelihood of saving the best for last in an MSWO. For example, future studies could compare the responding of participants with and without intellectual disabilities, with different degrees of verbal abilities, or with different language measures that may consider both expressive and receptive abilities. Perhaps more systematic evaluations could lead to the development of screening tools that could be used to determine whether an MSWO is appropriate for specific participants, or whether the results need to be interpreted differently.

Finally, however, what seems most prudent is exposing stimuli to reinforcer assessments that include response requirements more like the conditions under which they will be used (e.g., Delmendo et al., 2009). Many clinicians use thinner schedules of reinforcement during programming than a fixed ratio 1, yet rely on a fixed ratio 1 schedule to identify the most robust stimulus (e.g., Francisco et al., 2008). Thus, a contribution of the current study is the use of tasks that were part of the participants' academic programming, and a progressive ratio reinforcer assessment, which demonstrated that MSWO rankings do not always hold up under more realistic learning conditions. Although we have discussed Jackson's responding as possibly saving the best for last, it might be that this is just one behavior analytic interpretation of the phenomenon. It is also possible that this "save the best for last" label is used to describe topographically similar response patterns with different functions (e.g., in one case the pattern is due to different reinforcer schedules between the assessment and treatment, in another case it is

because the taste of one food, which is somewhat reinforcing, negates the taste of a more preferred food and punishes eating the more preferred food first). However, additional data will be required to distinguish between the controlling variables for the observed response patterns, and the present data are but one small step in making this distinction possible.

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Table 1

Results of the Peabody Picture Vocabulary Test

		PPVT Score	
Participant	Age at test date	Standard Score (CI)	Age Equivalent
Jackson	9:10	74 (67-83)	6:7
David	15:6	43 (38-51)	5:11
Connor	9:7	61 (55-70)	5:2
Laura	9:11	70 (64-79)	6:1

Note. Ages are listed as years and months (y:m). PPVT = the Peabody Picture Vocabulary Test, fourth edition. A standard score indicates the distance of the participant's raw score from the mean for people of the same age. A standard score of 100 is the average score for the person's age. The standard deviation for the PPVT-4 standard scores is 15. CI = 95% confidence interval. An age equivalent represents the age at which a participant's raw score is the mean score in a growth curve across age.

Table 1

Overall Rank of Each Stimulus in the MSWO Preference Assessments for Each Participant

Participant	Stimuli	Number of Sessions	Overall Rank Across all Sessions (Order Selected in Each Session)				
			1	2	3	4	5
Jackson	Edibles	3	Veggie Straws (1-1-1)	Chips (2-2-2)	M&M's (4-3-3)	Chocolate-covered Pretzels (3-4-4)	Fruit Snacks (5-5-5)
	Leisure	3	Hula Hoops (1-1-1)	Slinkies (2-2-2)	Bubbles (4-3-3)	Play Doh (3-4-4)	Slime (5-5-5)
David	Leisure	3	Slime (1-1-1)	Spinning Top (3-2-3)	Squeeze Ball (2-5-2)	Slinky (4-4-4)	Rubix Cube (5-3-5)
	Edibles	4	Chip & French Onion Dip (1-1-4-1)	Popcorn (4-2-2-2)	Chip & Ranch Dip (3-4-1-3)	Goldfish (2-3-3-4)	Twix Bar (NS)
Connor	Edibles	5	Chips Ahoy (1-2-1-2-1)	Oreos (2-3-2-1-2)	Fruit Snacks (4-4-3-3-3)	Veggie Straws (3-5-4-4-4)	PopChips (5-1-5-5-5)
	Leisure	3	Slime (1-1-1)	Slinkies (2-2-2)	Spikey Ball (3-3-3)	Bubbles (4-4-4)	Play Doh (5-5-5)
Laura	Leisure	3	Tablet (1-1-1)	Shimmer & Shine Toy (2-2-2)	Coloring Book (4-4-3)	Water Hoop Game (5-3-4)	Jewelry (3-5-5)
	Edibles	5	Fruit Snacks (2-1-1-1-1)	Utz Chips (1-2-4-4--)	Ginger Snaps (3-4-2-2--)	PopChips (4-3-3-3--)	Graham Bunnies (NS)

Note. Numbers in parenthesis underneath each stimulus indicate the order in which the stimulus was selected in each session, respectively. NS = Never Selected. Laura only consumed fruit snacks in the last session of the MSWO.

Table 2

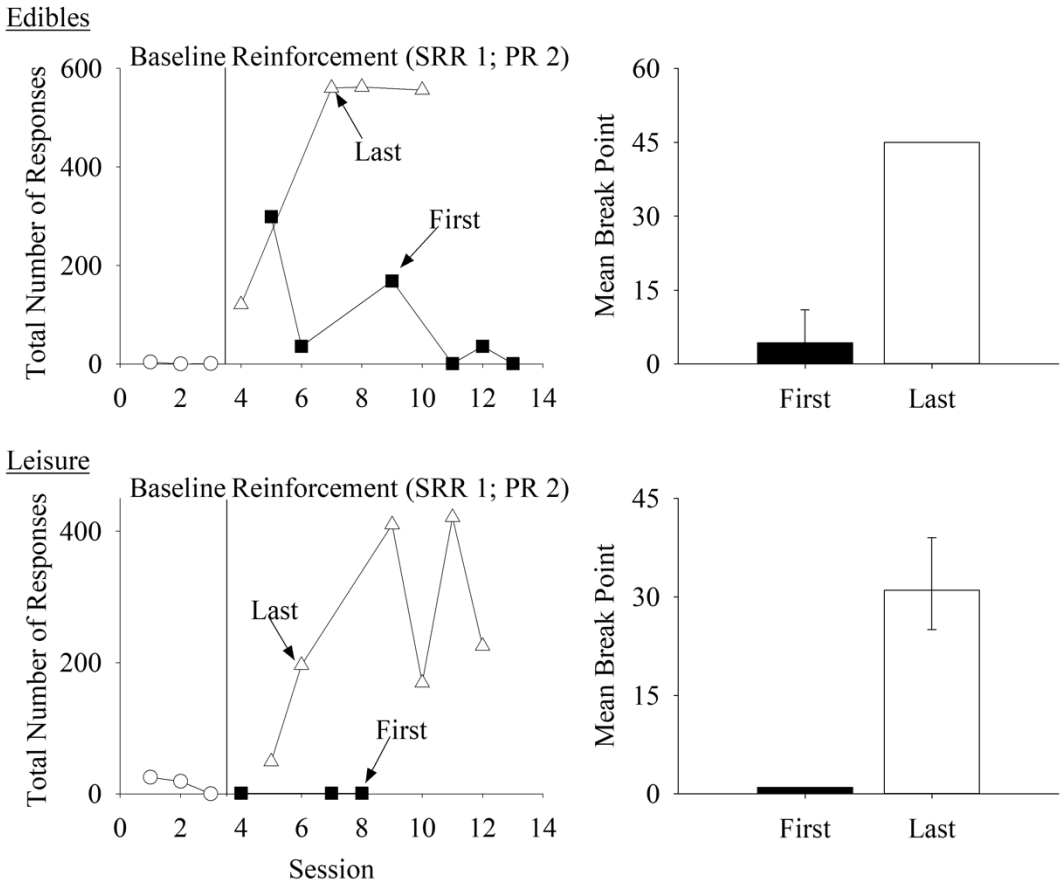
Days to Complete Each Reinforcer Assessment

Participant	Reinforcer Assessment		Days from	
	Stimuli	Number of Sessions	End of MSWO to Start of Baseline[a]	Start of Baseline to End of Reinforcer Assessment[b]
Jackson	Edibles	13	1	22
	Leisure	12	2	11
David	Leisure	18	16	49
	Edibles	11	2	11
Connor	Edibles	14	0	24
	Leisure	10	4	9
Laura	Leisure	15	2	23
	Edibles	14	5	9

Note. [a] Days from last MSWO session to first baseline session. [b] Days from first baseline session to last PR session. The initial assessments for each participant took more time to complete due to participant absences, other educational priorities for the participants (e.g., Connor's rescheduled speech or OT sessions) and school closings.

Figure 1

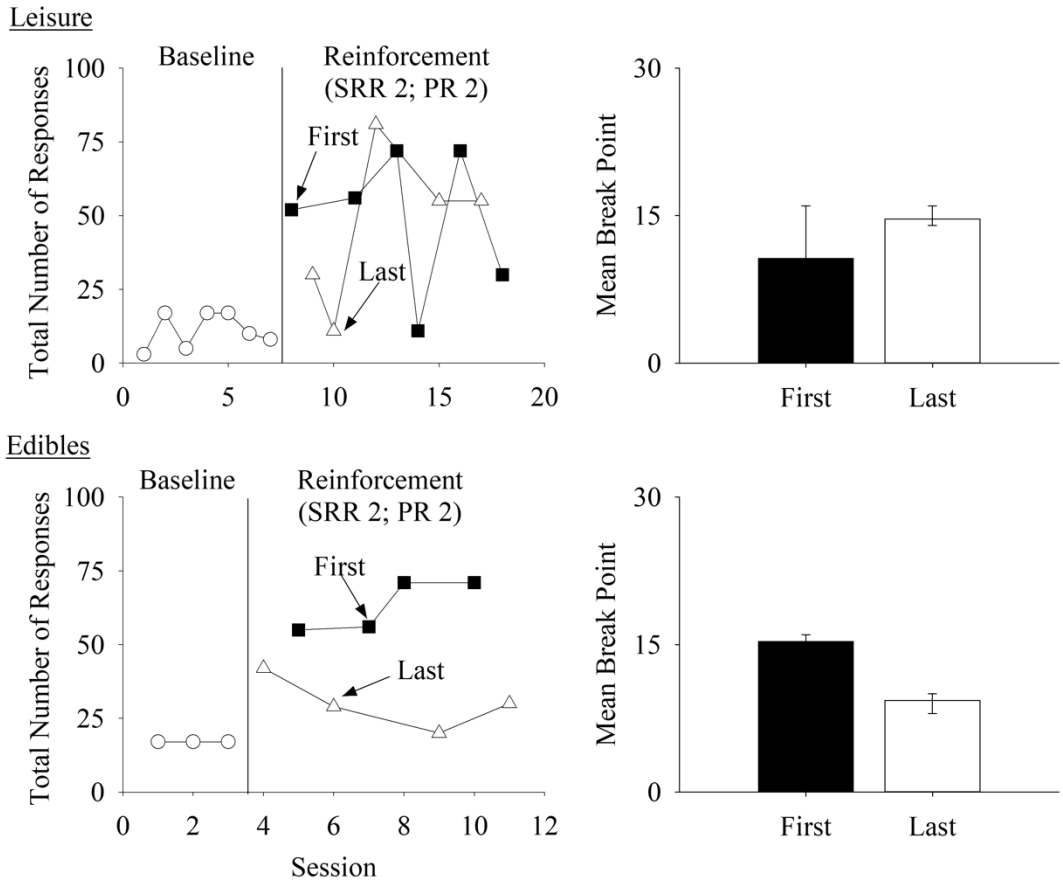
Results of Jackson's Reinforcer Assessments



Note. Top panels depict the assessment of edibles and bottom panels depict the assessment of leisure items. In the left panels, the closed squares depict reinforcement sessions with the stimulus ranked first in the MSWO. The open triangles depict reinforcement sessions with the stimulus ranked last in the MSWO. The bar graphs (right panels) depict the mean break point (last schedule value completed) across the last three sessions for each stimulus. The error bars depict the range of break points for each stimulus. SRR = Starting response requirement. PR = progressive ratio step size.

Figure 2

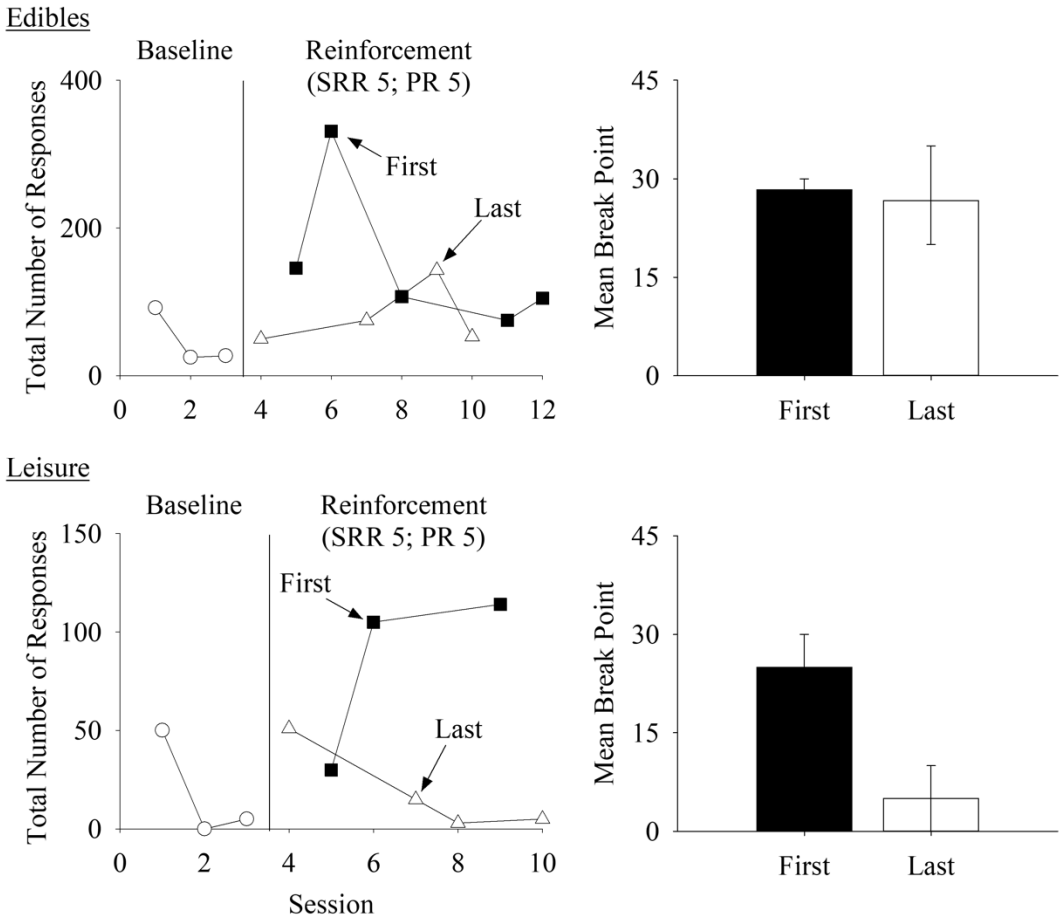
Results of David's Reinforcer Assessments



Note: Top panels depict the assessment of leisure items and bottom panels depict the assessment of edibles. In the left panels, the closed squares depict reinforcement sessions with the stimulus ranked first in the MSWO. The open triangles depict reinforcement sessions with the stimulus ranked last in the MSWO. The bar graphs (right panels) depict the mean break point (last schedule value completed) across the last three sessions for each stimulus. The error bars depict the range of break points for each stimulus. SRR = Starting response requirement. PR = progressive ratio step size.

Figure 3

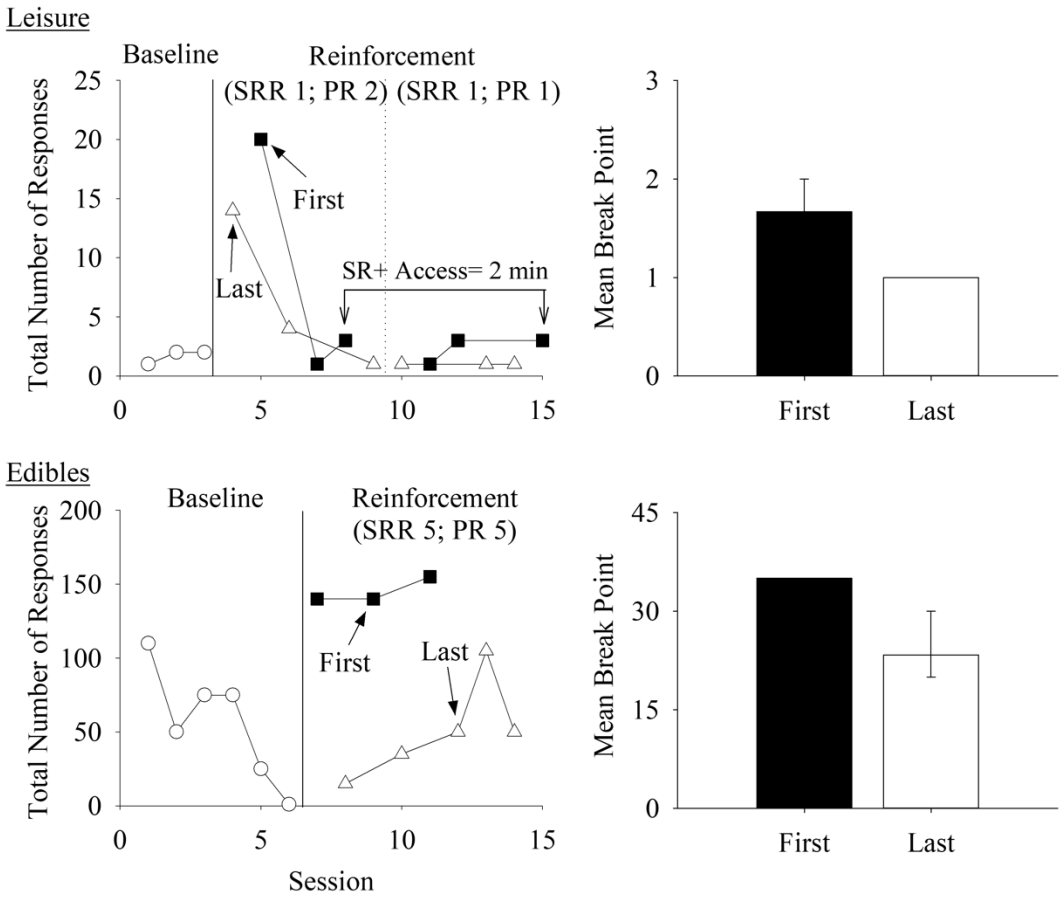
Results of Connor's Reinforcer Assessments



Note: Top panels depict the assessment of edibles and bottom panels depict the assessment of leisure items. In the left panels, the closed squares depict reinforcement sessions with the stimulus ranked first in the MSWO. The open triangles depict reinforcement sessions with the stimulus ranked last in the MSWO. The bar graphs (right panels) depict the mean break point (last schedule value completed) across the last three sessions for each stimulus. The error bars depict the range of break points for each stimulus. SRR = Starting response requirement. PR = progressive ratio step size.

Figure 4

Results of Laura's Reinforcer Assessments



Note: Top panels depict the assessment of leisure items and bottom panels depict the assessment of edibles. In the left panels, the closed squares depict reinforcement sessions with the stimulus ranked first in the MSWO. The open triangles depict reinforcement sessions with the stimulus ranked last in the MSWO. The bar graphs (right panels) depict the mean break point (last schedule value completed) across the last three sessions for each stimulus. The error bars depict the range of break points for each stimulus. SRR = Starting response requirement. PR = progressive ratio step size.