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Do Children Who Exhibit Food Selectivity Prefer to Save the Best (Bite) for Last?

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Abstract

Preference for patterns of outcomes that improve over time is termed *negative time preference*, in economics. In lay terms, this concept equates to “saving the best for last.” Generally, adults tend to prefer to postpone their more preferred outcomes when options are presented as a sequence of events. Event sequencing seems particularly relevant for children who exhibit food refusal or selectivity. Preference for the sequencing of bites when an array involved preferred and relatively non-preferred foods was evaluated. Participants experienced pre-programmed bite sequences that improved, worsened, or remained fixed across trials, and we assessed participants’ preference for each of the bite sequences. Three of the four participants preferred bite sequences that began with a highly preferred food and either worsened or remained fixed over time, whereas one participant preferred the improving sequence of bite presentation, or in other words, one participant preferred to “save the best for last.”

Key words: autism spectrum disorder, negative time preference, choice, positive time preference, saving the best for last, translational research

Do Children Who Exhibit Food Selectivity Prefer to Save the Best (Bite) for Last?

Potential reinforcers are typically identified through preference assessments, such as the paired-stimulus (PSPA; Fisher et al., 1992) and the multiple stimulus without replacement (MSWO; DeLeon & Iwata, 1996) formats. The MSWO is frequently used to assess preference because it allows for the relatively simple and efficient identification of a preference hierarchy (Karsten et al., 2011). In this assessment, an individual selects one item from an array and is provided access to that item. Following consumption (edible) or a predetermined access interval (nonedible), the selected item is not replaced or returned to the array, and the individual makes another selection from among the remaining stimuli. The assessment continues until no items remain or until a period from the onset of a trial has elapsed without a selection (e.g., 30 s). Stimuli are ranked by the order in which they were selected (DeLeon & Iwata, 1996).

Although researchers have good reason to believe that items selected first in the MSWO assessment are the most highly preferred (DeLeon & Iwata, 1996), research has shown that low-ranked items in an MSWO may also function as effective reinforcers (Francisco et al., 2008; Francisco et al., 2009). One reason that low-ranked items might serve as reinforcers is that, for some individuals, item selection might be characterized as “saving the best for last,” meaning that the items selected last may be more preferred than those selected first (e.g., Fritz et al., 2020). Some researchers have elected to use PSPAs in lieu of the MSWO in an effort to circumvent a preference to save the most preferred item for last (e.g., Solberg et al., 2007).

In economics, saving the best for last, or a preference for future over immediate consumption is referred to as *negative time preference* (Loewenstein & Prelec, 1991, 1993). Negative time preference has been previously studied with questionnaires that ask individuals to make choices between sequences of qualitatively different outcomes experienced at varying

points in time. Loewenstein and Prelec (1991, 1993), for example, asked participants to choose between eating at a fancy restaurant and eating at a local restaurant. Participants who initially chose the fancy restaurant were then asked to select between eating at the fancy restaurant in one month and the local restaurant in two months or eating at the local restaurant in one month and the fancy restaurant in two months. Most participants chose to postpone dinner at the preferred restaurant, selecting the option in which outcomes improved over time (i.e., saving the best for last). More recently, Castillo et al. (2021a) reported a systematic replication of both procedures and findings described by Loewenstein and Prelec (1991, 1993). Further, with human adults as subjects, these effects have been replicated across a variety of hypothetical outcomes, including money (Magen et al., 2008), environmental and health outcomes (Guyse et al., 2002), grades (Hsee et al., 1991), and noxious stimuli (Castillo et al., 2021b), with the results indicating a preference for sequences of outcomes that improve over time.

As just noted, previous research on this topic has typically involved single-shot questionnaires in which participants were asked to respond to hypothetical scenarios without ever experiencing the outcomes that they selected. Andrade and Hackenberg (2012) extended this line of research by evaluating pigeon and human choices between various sequences of reinforcement across repeated exposures to experiential stimuli (i.e., food for pigeons and video segments for humans). Three sequences of reinforcement were presented: (a) *improving* (i.e., time between stimulus presentations systematically decreased), (b) *worsening* (i.e., time between stimulus presentations systematically increased), and (c) *standard* (i.e., time between stimulus presentations remained fixed). Both pigeons and humans demonstrated a preference for reinforcer sequences that worsened over time. This contradicts findings from questionnaire

studies, which demonstrate that humans prefer improving sequences of reinforcement (i.e., saving the best for last, e.g., Loewenstein & Prelec, 1991, 1993).

One possible explanation for this discrepancy may involve the use of real versus hypothetical outcomes. It seems possible that individuals prefer sequences that improve over time when presented with hypothetical outcomes but may prefer sequences that worsen over time when presented with real outcomes. This supposition, however, is mitigated by data from delay discounting research in which real and hypothetical outcomes produce similar levels of discounting (Johnson & Bickel, 2002). Similarly, Castillo et al. (2021b) examined correspondence between adults' preference for the order in which they would experience sequences of categorically different outcomes (e.g., academic tasks, foods) when those were hypothetical versus real. Results showed very strong correspondence in the ranks assigned to the hypothetical and real outcomes.

Another explanation for the discrepancy in findings may be that the questionnaire studies manipulated multiple dimensions of reinforcement simultaneously as opposed to manipulating only one dimension. Loewenstein and Prelec (1991, 1993) evaluated time preference by simultaneously manipulating the type of restaurant (i.e., quality) and the timing during which that option was available (i.e., delay). Alternatively, Andrade and Hackenberg (2012) did not manipulate the quality or magnitude of reinforcers delivered. It may be that when qualitatively different outcomes are presented in varying temporal arrangements, individuals prefer to postpone more preferred (i.e., higher quality) outcomes for later relative to less preferred (i.e., lower quality) outcomes. However, when quality is kept constant, individuals prefer the most immediate access to reinforcers.

The extent to which negative time preference exists for children remains a matter of considerably less research. Castillo et al. (2021b), Study 2, assessed the preferences of four typically developing preschool children across an array of category types to assess whether a tendency to save the best for last was determined in part by the type of stimulus under consideration (e.g., food vs an activity). Specifically, children experienced a series of paired stimulus preference assessments using procedures similar those described by Fisher et al. (1992). The categories were: (a) academic, (b) story time, (c) food, (d) exercise, (e) leisure, and (f) a mixed category. In each category, five options were assessed. For example, in the academic category, children were presented with a tracing task, a lacing task, a shape identification task, a counting task, and a letter identification task. The tasks were presented in pairs, and children were prompted to select the one they wanted. Similarly, in the food category, five foods were nominated as preferred, and then participants were presented with the foods, in pairs, and asked to choose the one they wanted. A hierarchy of preference was determined for each category, and then children were asked to tell the experimenter the sequence that they wanted to experience the options in each category. Of the four typically developing preschoolers who participated, two of four chose to save the best for last in the academic category, and one of four chose to save the best for last across exercise, story time, food, or a mix of all categories. Notably however, none of the children chose to save the best for last with the leisure items, and only one of four elected to save the best for last in the food category.

The notion that certain temporal distributions of stimuli may be preferred seems particularly relevant to the treatment of food selectivity. *Food selectivity by variety* has been defined as accepting a narrow range of nutritionally inappropriate foods and refusing other foods across all textures (Munk & Repp, 1994; Piazza, 2008). As many as 33% of toddlers evince

some degree of food selectivity (Manikam & Perman, 2000), and among children diagnosed with an autism spectrum disorder, this figure is as high as 90% (Kodak & Piazza, 2008).

An improving sequence of outcomes may be arranged in the context of a treatment for food selectivity by structuring the meal in such a way that all the least preferred bites of food are presented at the beginning of the meal and all the most preferred bites of food are presented at the end of the meal. A preference for such an improving sequence may be akin to “saving the best for last” amongst children who exhibit food selectivity. Assessing whether children who exhibit food selectivity prefer to “save the best for last” and arranging the order of bite presentation accordingly could be considered an important measure of social validity in that it would allow beneficiaries of treatment a role in the design of their own treatment. The purpose of the present study was to evaluate child *preference* for improving, worsening, and standard sequences of bite presentation so that these results might be considered when designing future research to address acceptance, latency to bite acceptance, and inappropriate mealtime behavior (IMB). The present study is best conceptualized as one of choice and child preference evaluated rather than an evaluation of treatments designed to address food selectivity, though the authors have attempted to make the implications for the latter apparent.

Method

Participants

Participants were four individuals admitted to an inpatient or intensive day treatment program for the treatment of pediatric food refusal. Though avoidant restrictive food intake disorder (ARFID) is a more contemporary diagnosis, none of the participants in the present study carried that diagnosis. Only individuals for whom food selectivity by variety was the primary presenting problem and for whom an effective treatment package had already been determined

were eligible to participate. Additionally, all participants were required to accept food from a spoon, accept a variety of foods on a consistent basis, and make choices between pairs of foods using picture cards as stimuli.

Jack was an 8-year-old boy of neurotypical development. Upon admission to the program, Jack consumed only Wegmans cinnamon donut holes, brand specific graham crackers, Cheese-Its®, Cheerios®, Goldfish, Cheetos®, Doritos®, Pirate's Booty®, pretzels, and fruit snacks. Jack also drank Pediasure® to meet his caloric needs. Jessie was a 10-year-old girl diagnosed with autism spectrum disorder. Upon admission to the program, Jessie consumed only sunny-side up or hard-boiled eggs, brand specific potato chips, Colby-Jack cheese, creamy peanut butter mixed with Nutella®, brand specific chicken nuggets, French fries with salt and ketchup, Ellio's® cheese pizza, and brand specific chocolate chip cookies. Jessie met all her caloric needs via oral consumption of a limited variety of solid foods. Sam was a 6-year-old boy diagnosed with Ehlers-Danlos syndrome type 3 (joint hypermobility type), autism spectrum disorder, anxiety disorder, lung disease, and hypogammaglobulinemia. Sam consumed only potato chips, regular and honey mustard pretzels, Hershey's® chocolate bars, McDonald's® French fries, and Danimals® strawberry yogurt upon admission. Sam also received Nutren Junior® formula via gastrostomy tube to meet his caloric needs. Riley was a 5-year-old boy of neurotypical development with a history of milk and egg allergies, gastroesophageal reflux, and failure to thrive. Upon admission to the program, Riley consumed a limited variety of foods including lasagna, minestrone soup, chicken lo mein, fried rice, steamed vegetables with butter, and baked fish. Riley also drank Pediasure® to meet his caloric needs. The treatment procedures in place throughout the entire study for each participant are displayed in Table 1. Upon admission, all participants were evaluated by select members of the interdisciplinary team (i.e., medicine,

nutrition, occupational and speech therapists) and deemed safe oral eaters. Medicine and nutrition approved the food selected for each participant to ensure safe foods were presented.

Setting and Materials

All sessions took place in 3 m by 3 m session rooms equipped with an observation window. Seating arrangements were determined on an individual basis and consisted of a table and chair (Jack and Riley) or a Rifton® chair (Jessie and Sam). Materials included all items relevant to a typical feeding session (e.g., plates, napkins, spoons, timers, a video camera) as well as any materials specified by a participant's individualized treatment protocol (e.g., toys, DVDs, iPad). Additionally, materials included three colored poster boards visually depicting the three bite sequences under evaluation in a flowchart format and a “next up” bite binder indicating the next bite to be presented in each sequence of outcomes. Illustrations are provided as Supporting Information (Figures A1 and A2).

Response Measurement

Data were collected on participant selections using pencil and paper. A selection was defined as the participant touching, pointing to, or vocally identifying a single-colored poster board representing a particular bite sequence within 5 s of initial presentation of the stimuli. All available sequences were listed on a paper datasheet, and once per trial, data collectors circled the sequence indicated by the participant. Additionally, all previously defined responses continued to be scored on laptop computers throughout the preference evaluation. During the preference evaluation, data were also recorded on a variety of participant responses related to the mealtime context on laptop computers using the Instant Data PC® software. *Acceptance* was defined as the entire bite of food being deposited inside a participant's mouth within 5 s of initial bite presentation or within 10 s of swallowing the previous bite for independent eaters. *Latency*

to acceptance was defined as the amount of time that elapsed from bite presentation until the entire bite was deposited into the participant's mouth. This measure was averaged across all bite presentations within a session. *Inappropriate mealtime behavior* was scored each time participants engaged in any of the following responses during bite presentation: turning their head more than 45° past the midline, making physical contact with any part of the feeder's arm or hand, batting at or touching the spoon or food (in a manner not conducive to self-feeding), attempting to block access to the mouth by placing hands or any object in front of the mouth (touching or within 5 cm).

Experimental Design

A concurrent-chains arrangement, as described by Frank-Crawford et al. (2019), was used to assess preference for each of the bite sequences. In the initial-link, bite sequences (improving, worsening, or standard) were represented visually on different colored poster boards (see Supporting Information). An MSWO preference assessment was conducted with seven colors, and the third, fourth, and fifth ranked colors were used to prevent a color selection bias during the preference evaluation (Jessie, Sam, and Riley). A small, laminated photograph of the appropriate food depicted each bite. The visual bite sequence progressed horizontally from left to right, dropping down to the next row after every four bites. In the initial link, which occurred at the start of each session, all three colored poster boards were presented, and participants were permitted to make an independent selection from the available alternatives. In the terminal-link, participants experienced the sequence corresponding to the colored poster board selected in the immediately preceding initial-link. The poster board depicting the selected sequence remained visible throughout the entire session. Sessions consisted of eight trials arranged in a particular

order corresponding to one of the three bite sequences. For each participant, sessions were conducted five to seven days per week with three to six sessions per day.

Interobserver Agreement and Procedural Integrity

A second observer independently collected data for at least 33% of all sessions for all participants. For the sequence selection data collected during the preference evaluation, interobserver agreement was calculated using the trial-by-trial method (Cooper et al., 2007). Agreement was defined as both observers circling the same color on a pencil-paper data sheet. The number of trials with agreement was divided by the total number of trials in the evaluation, and this number was converted to a percentage. The percentage of sessions from each condition for which a second observer collected data and the mean agreement for each condition are displayed for all participants in Table 2.

Integrity was scored for at least 33% of all sessions for all participants. For the preference evaluation, four therapist responses were scored during each bite presentation: vocally informing the participant of the upcoming bite, turning the page in the bite binder to display the next food in the sequence, presenting a bite of the correct food, and leaving the appropriate colored poster board within view throughout the session. The number of correct responses was divided by the total number of opportunities and converted to a percentage. The percentage of sessions from each condition for which treatment integrity was scored and the mean integrity score for each condition are displayed for all participants in Table 3.

Procedures

2D-3D match-to-sample assessment. A 2D-3D match-to-sample assessment was conducted to ensure that participants could match that the 2D pictures of food used in the edible preference assessment (described next) and the initial-link of the concurrent-chains arrangement

with the 3D solid foods that they were expected to consume. Participants were first required to label each of the 2D and 3D stimuli in isolation. The experimenter held up a 7.62 cm by 12.7 cm index card displaying a photograph of food or a small bite of food on a paper plate and asked the participant, “What is this?” No differential consequences were provided for correct or incorrect responses. After the participant had been provided an opportunity to label both a 2D and a 3D stimulus for each of the foods in his or her current variety, the matching assessment was conducted. An array of four bites of food was arranged on a table in front of the participant. The participant was handed an index card displaying a photograph that corresponded to one of the foods in the array. The experimenter instructed the participant to, “Match it.” No differential consequences were provided for correct or incorrect responses. This process continued until one trial was presented for each of the foods selected for inclusion in the edible preference assessment (described below). Only those individuals who responded correctly during at least 80% of trials were invited to participate in subsequent phases of the investigation. All participants met this criterion.

Edible preference assessment. A preference assessment as described by Fisher et al. (1992) was conducted to determine the level of preference for each of the foods used in the current study. A minimum of 12 foods was included in the assessment. Foods were selected from those currently specified by each participant’s individualized treatment protocol; however, additional foods were added if a participant’s repertoire did not already include 12 foods.

During the edible preference assessment, pictures of foods were presented on index cards. Two cards were presented simultaneously, the participant was instructed to pick one, and their choice was recorded. Immediately following selection of a stimulus, the next trial was initiated. Trials continued until each food had been paired one time with every other food in the

assessment. Foods selected during 75-100% of trials were categorized as high-preferred (HP), foods selected during 50-74% of trials were categorized moderately preferred (MP), foods selected during 25-49% of trials were categorized as low-preferred (LP), and foods selected during 0-24% of trials were categorized as nonpreferred (NP).

General procedures. One or two sessions were conducted per meal with three meals scheduled each day. Four foods, one from each preference category, were presented in each session. A session consisted of eight bites broken down into two bites of each food. Sessions were terminated following the consumption of all eight or when the individually determined time cap was met (the latter criterion was never used). Participants were permitted to make an independent selection from the available alternatives during the concurrent-chains arrangement. The therapist presented the participant with three colored poster boards depicting all three available bite sequences and described each one by saying “Today we have the [color 1] sequence, the [color 2] sequence, and the [color 3] sequence. We are going to take some bites and then we can take a break. Pick the sequence you like the best.” Immediately upon selecting in the initial-link, the participant experienced the corresponding terminal-link. Therapists continued to follow the individualized treatment protocol designed for each participant, and only the sequence of bite presentation was manipulated. Three unique sequences of bite presentation were evaluated: standard, worsening, and improving. During the *standard* sequence, the degree of preference cycled evenly across the session as follows: one bite of a HP food, one bite of a MP food, one bite of a LP food, and one bite of a NP food. After each bite of a NP food the rotation started over beginning with the HP food. This rotation continued until all eight bites had been presented. During the *worsening* sequence, the degree of preference decreased across the session as follows: two consecutive bites of a HP food, two consecutive bites of a MP food, two

consecutive bites of a LP food, and two consecutive bites of a NP food (illustrative of positive time preference). During the *improving* sequence, the degree of preference increased across the session as follows: two consecutive bites of a NP food, two consecutive bites of a LP food, two consecutive bites of a MP food, and two consecutive bites of a HP food (illustrative of negative time preference). During implementation of all sequences, the next bite to be presented was displayed visually in a “bite binder” (see Supporting Information). Following the presentation of each bite, the page on display was flipped to reveal the subsequent bite in the sequence. This manipulation was made to enhance discriminations between each of the three sequences of bite presentation under evaluation and based on thematically related research on behavior in transition (e.g., Perone & Courtney, 1992).

The preference evaluation continued until at least nine preference trials had been conducted and until a clear preference had been determined via visual inspection. The sequence corresponding to the colored poster board selected most frequently was considered the highest preferred sequence.

Results

Figure 1 depicts the results of the initial-link selections for all participants. After a sequence was selected in the initial-link, a session was conducted using that sequence in the terminal-link. Of the four participants, Jack was the only one to reliably select the improving sequence, thus, saving the most preferred bite for last, in the sequence. By contrast, Sam (third panel), consistently selected the worsening sequence, wherein his most preferred foods were presented first. Jessie (second panel) and Riley (bottom panel) selected the standard sequence, and the worsening sequence similarly, but rarely selected the improving sequence.

The researchers also measured acceptance, latency to bite acceptance, and inappropriate mealtime behavior. Figure 2 depicts data for acceptance in the terminal link of the concurrent-chains arrangement. Jack's mean acceptance in the improving sequence exceeded 90% (top panel). His acceptance in the single session of the worsening sequence was 87.5%, and his acceptance in the single session of the standard sequence was 100%. Mean acceptance for Jessie (second panel) exceeded 90% across all sequences. Thus, sequence did not appear to influence acceptance, for Jessie. Sam consistently selected the worsening sequence, for which mean acceptance was 75%, and mean acceptance was also 75% for the two sessions in which he selected the standard sequence. Acceptance was 87.5% in the single session in which Sam selected the improving sequence. Notably acceptance was trending downward throughout the assessment, though acceptance did not appear to be differentially impacted by sequence. Riley's mean acceptance in the standard condition was higher than that in the worsening condition (96.88% and 82.4%, respectively). Riley's acceptance was 100% in the single session in which he selected the improving sequence.

Table 3 depicts sequence means for latency to acceptance, reported in seconds, and means for inappropriate mealtime behavior, reported as responses per minute. Mean latency to acceptance was below 5 s for Jessie, Sam, and Riley, regardless of sequence. Jack's latency to acceptance was slightly above 5 s in the standard sequence, and his mean latency to acceptance was also slightly above 5 s for the improving sequence. Two participants, Jack and Jessie exhibited no inappropriate mealtime behavior in the terminal links, whereas Sam and Riley only exhibited IMB in the worsening sequence, though the rate was quite low.

Discussion

This study began *after* an effective intervention was identified to address food selectivity, at which point we assessed preference for bite sequences for four children. Results of the concurrent-chains preference assessment showed that one of four children exhibited a preference to save the best bite for last, reflective of a negative time preference, one showed a strong preference for the worsening sequence, reflective of a positive time preference, and two children preferred the standard and worsening sequences similarly, and to a greater degree than the improving sequence. After selecting how they would experience their bites, Jack and Jessie generally accepted bites similarly, despite the sequence. Acceptance for Sam seemed to deteriorate across the course of the assessment, but again, based on the data available, there did not appear to be a differential effect of sequence on acceptance. For Riley, acceptance did appear to be influenced by bite sequence, with the standard sequence producing slightly higher levels of acceptance relative to the worsening condition, both of which were selected on a nearly equal number of opportunities.

That acceptance was similar for three children (Jack, Jessie, and Sam), regardless of bite sequencing, suggests that we have an opportunity to provide the recipients of our behavioral services with the power of choice, without sacrificing the integrity or the quality of our behavioral interventions. This point cannot be underscored enough. By providing recipients of our services with the power to choose (Bannerman et al., 1991), we actively incorporate those individuals into the treatment planning process (Becraft et al., 2017; Dozier et al., 2007), we empower individuals of neurodiverse backgrounds (Hanley, 2010), and we demonstrate compassion in our therapeutic service provision (Taylor et al., 2019). Where differential effects of sequence were noted (Riley), we are presented with a unique opportunity. Riley's initial link

selections of the standard and worsening sequences were almost identical. Thus, by voting with his feet, Riley told us that he preferred the arrangements about equally. Given the indifference between conditions, we, as therapeutic services providers, can then use data to make decisions about which arrangement would best serve Riley. In this case, for Riley, we learned that his acceptance was higher in the standard condition. Thus, without compromising the power of choice, Riley can take his bites in a sequence that he prefers, with acceptance at levels that meet treatment goals agreed upon by his service providers and family.

The title poses the experimental question that we sought to answer in this study, *do children who exhibit food selectivity prefer to save the best (bite) for last?* The conservative estimation from our sample of four children would be, “no, not most.” However, we continue to see references to the “saving the best for last” phenomenon in the literature, and we continue to see evidence of it in our research and in our practice. And the fact that one of four children demonstrated a negative time preference—evinced saving the best for last—suggests that the phenomenon is not common, but that it does occur. Recall that results of the study by Castillo et al. (2021b) showed that, of the four typically developing preschoolers who participated, one of four elected to save the best for last in the food category. One of four, just like the findings of the present study. Although we initiated this study with the assumption that children who exhibited food selectivity may be *more* likely to show a positive time preference than typically developing preschoolers, findings from the present study and those of Castillo et al. (2021b) suggest that being food selective does not mean that one is more likely to exhibit positive time preference. Although the samples from the present study and Castillo et al. are small, there is general replication across these studies, which may serve as a starting point for future conversations

regarding the generality of the saving the best for last (negative time preference) phenomenon (e.g., Walker & Carr, 2021).

A potential explanation for *why* some children prefer an improving sequence whereas others prefer a worsening sequence merits speculation. Let us begin with consideration of Jack's negative time preference. One possible explanation could be related to cognitive development. Under control conditions, in which no potentially mediating self-vocalizations are prompted, third-grade students (M , 8.7 years old) have demonstrated better tolerance of delays to reinforcement than kindergarten students (M , 5.3 years old), and children who have autism have demonstrated greater difficulty delaying gratification as compared to their same-age, typically developing peers (Faja & Dawson, 2015; Miller et al., 1978). Of the two participants who did not have a diagnosis of autism spectrum disorder, Jack was older by three years. Therefore, as an 8-year-old of neurotypical development, it is possible that Jack was better able to tolerate delays. To be clear, we are not suggesting that the explanation for delay tolerance is to be found in "cognitive development." Instead, we are suggesting that with greater age, comes more experience with delays, more experience with denials, more prompts to tolerate delays, and perhaps, greater delay tolerance. A second potential explanation may be related to the features of Jack's individualized treatment protocol that differed from those of the other participants. Jack was the only participant for whom no intrusive components (e.g., nonremoval of the spoon, representation of expels) were necessary at any point during his mealtime protocol. Furthermore, Jack was the only independent eater, whereas the other participants were provided a verbal prompt to take each bite. The lack of intrusive components and the greater independence provided to Jack also may have influenced his preference for the improving sequence.

Unlike Jack, the remaining three participants seemed to prefer sequences that worsened over time. Although Jessie and Riley indicated indifference between the standard and worsening sequences; because the standard sequence always began with a HP food and always ended with a NP food, the standard sequence may be viewed as a variation of the worsening sequence. We elected to design the standard sequence in this way because starting with the highest preferred food and moving down the preference hierarchy prevented participants from ever having to transition from a high-preferred food to a nonpreferred food—a transition associated with increased pausing (e.g., Perone & Courtney, 1992). Despite potential similarities between the worsening and standard sequences, we hypothesized that a sequence that worsened across only four bites before starting over may produce different outcomes than a sequence that worsened continuously across an eight-bite session. However, such differential outcomes were not observed. Given that both the worsening and standard sequences involved moving down the preference hierarchy, it is not surprising that two participants indicated indifference between these sequences. Overall, the results of the present study indicate that, in general, children with food selectivity prefer to experience their more preferred outcomes prior to experiencing their less preferred outcomes and, therefore, do not prefer to “save the best for last.”

There may be several explanations for the discrepancy between the present results and the results of previous questionnaire studies that found that adult humans prefer to “save the best for last” (e.g., Guyse et al., 2002; Hsee & Abelson, 1991; Loewenstein & Prelec, 1993; Magen et al., 2008). One possibility may be that preference for foods changed throughout the course of the evaluation. Food preferences were only evaluated in an edible preference assessment one time immediately prior to the onset of the baseline condition. Because preference was not reassessed on multiple occasions throughout the course of the study, it is possible that foods previously

determined to be low or nonpreferred may have become more preferred over time because of repeated exposure. Therefore, at some point, preference categories may have no longer been reflective of current preferences, and participants may not have experienced the various bite sequences as they were intended. This matter could be addressed in future research by reassessing preference throughout the course of the evaluation by conducting additional preference assessments.

Alternatively, the lack of “saving the best for last” observed in the present study may be explained within the context of the delay discounting framework. Delay discounting posits that the value of a reward decreases as the delay to receiving that reward increases (Leon et al., 2016). During the improving sequence, the delay to the presentation of a high-preferred food was quite large as compared to the worsening and standard sequences in which a high-preferred food was presented immediately. It is possible that this delay resulted in the devaluation of the highest preferred foods in the improving sequence so that these foods were no longer as highly preferred as they were when presented without a delay. This effect may have contributed to the preference for the worsening and standard sequences observed for most participants.

Results of the preference evaluation have implications for the treatment of food selectivity and the design of behavioral assessment and intervention with this population more generally. The preference evaluation made evident that the individuals receiving behavior analytic treatment for food selectivity have clear preferences regarding the order in which bites are presented to them. Because none of the sequences were found to be more effective than any of the others for three of four participants (Riley was the exception), there may be little harm in presenting bites according to the sequence that is most preferred. Allowing consumers the opportunity to make choices related to their treatment is always beneficial in that the opportunity

to make a choice may be reinforcing in and of itself (Hanley, 2010; Hanley et al., 2005). Tailoring an intervention to the preferences of the consumer may enhance the buy-in of caregivers, teachers, or other individuals who will ultimately be asked to implement the intervention themselves. Furthermore, given that three out of four participants in the present study did not prefer to “save the best for last,” at least in the context of bite presentation, this may imply that, within the context of a preference assessment, these individuals would select first an item that is truly most preferred. Should this occur in practice, ongoing evaluation should occur to identify deterioration in effectiveness across time, particularly if children opt to leave the least preferred bites until the end of the meal.

The present investigation is not without limitations. One limitation is that the various bite sequences were presented only after an effective treatment package had already been established. This was to ensure that all participants were reliably consuming a variety of foods prior to evaluating the effects of manipulating the sequence according to which bites were presented. It would be difficult to determine the effects of the sequence of bite presentation if no bites were consumed. If an individual refused to consume any bites of food, the bite sequence would effectively cease to exist. Therefore, to evaluate the effects of and preference for various sequences of bite presentation, it was deemed critical to first establish a treatment that would increase bite consumption of a variety of foods to allow all sequences to be completed in their entirety. However, future research could involve periodic assessments of bite sequences, perhaps at the beginning, middle, and end of the treatment process. Generally, within the context of treatment for food refusal, escape extinction is frequently a necessary intervention component (Bachmeyer et al., 2009; Coe et al., 1997; Hoch et al., 1994; Patel et al., 2002; Piazza et al., 2003; Reed et al., 2004). For example, Piazza et al. (2003) found that positive reinforcement

alone was insufficient to increase bite acceptance and decrease IMB and that some form of escape extinction was necessary to achieve these results. Unfortunately, the use of escape extinction may be so effective that it could have obscured the role bite sequence played on mealtime behavior in the present study. A second limitation has to do with the heterogeneity of our participants. Two of four children carried a diagnosis of autism spectrum disorder, whereas two did not. There may be features of autism spectrum disorder that influence the nature of food selectivity (Twachtman-Riley et al., 2008). Further, some had histories of food allergies, others did not. Future evaluations of time preference in the context of food selectivity may be designed to focus exclusively on the preferences of those with autism spectrum disorder, with common medical histories. A final limitation has to do with the level of specificity provided by our edible preference assessment procedures. The paired stimulus preference assessment suggests relative preferences based on the options provided. Thus, an item that was categorized as “nonpreferred” in this study could have been one that was never selected (i.e., an aversive stimulus) or one that was simply selected (relatively less than another edible in the array). Future research may be designed to better quantify the categorization of stimuli, and in doing so the costs of more refined analyses should be weighed against benefits of doing so.

Behavior analysis and behavioral economics share considerable common ground (e.g., Borrero et al., 2007; Kagel & Winkler, 1972) as evinced by the proliferation of research on decision making generally, and delay discounting, specifically (Green & Myerson, 2004). In this study we selected a topic—event sequencing—with immediately exportable implications for the treatment of food selectivity. The present study is not the first to view feeding challenges through a behavioral economic lens (e.g., Kerwin et al., 1995), but it may be considered an additional bit of datum to underscore why such a lens may be practicable in the treatment of such challenges. By

recognizing that one's preferences for binary choice situations differ from one's preferences for event sequences, we may arrange more effective behavioral interventions that are preferred.

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Table 1*Treatment Components for Each Participant*

Participant	Procedures Included in Treatment Package
Jack	Self-feeder, full plate presentations, independent (unprompted) bites, noncontingent access to attention throughout the meal
Jessie	Self-feeder, single bite presentations, verbal prompt provided for every bite, nonremoval of the spoon, hand-over-hand, jaw prompt, flipped spoon, re-presentation of expels, differential reinforcement of alternative behavior (DRA) for swallowing
Sam	Self-feeder, single bite presentations, verbal prompt provided for every bite, nonremoval of the spoon, re-presentation of expels, DRA for swallowing
Riley	Self-feeder, full plate presentations, verbal prompt provided for every bite, nonremoval of the spoon, hand-over-hand, re-presentation of expels, post-meal reward for “beating the clock”

Table 2*Interobserver Agreement and Procedural Integrity for Each Participant*

Participant	Initial-Link Trials		Terminal-Link Trials		Acceptance	Latency to Acceptance	IMB	Integrity	
	% of Sessions with IOA	<i>M</i> % Agreement	% of Sessions with IOA	<i>M</i> Agreement				% of Sessions with TI	<i>M</i> % Agreement
Jack	100	100	33	99.12	100	82.26	100	33	100
Jessie	85	100	45	98.25	98.67	93.55	100	35	100
Sam	40	100	53	98.82	98.4	95.82	99.37	33	100
Riley	94	100	38	98.94	98.9	87.25	100	38	99.31

Note. *M* = mean, IMB = Inappropriate Mealtime Behavior, TI = Treatment integrity.

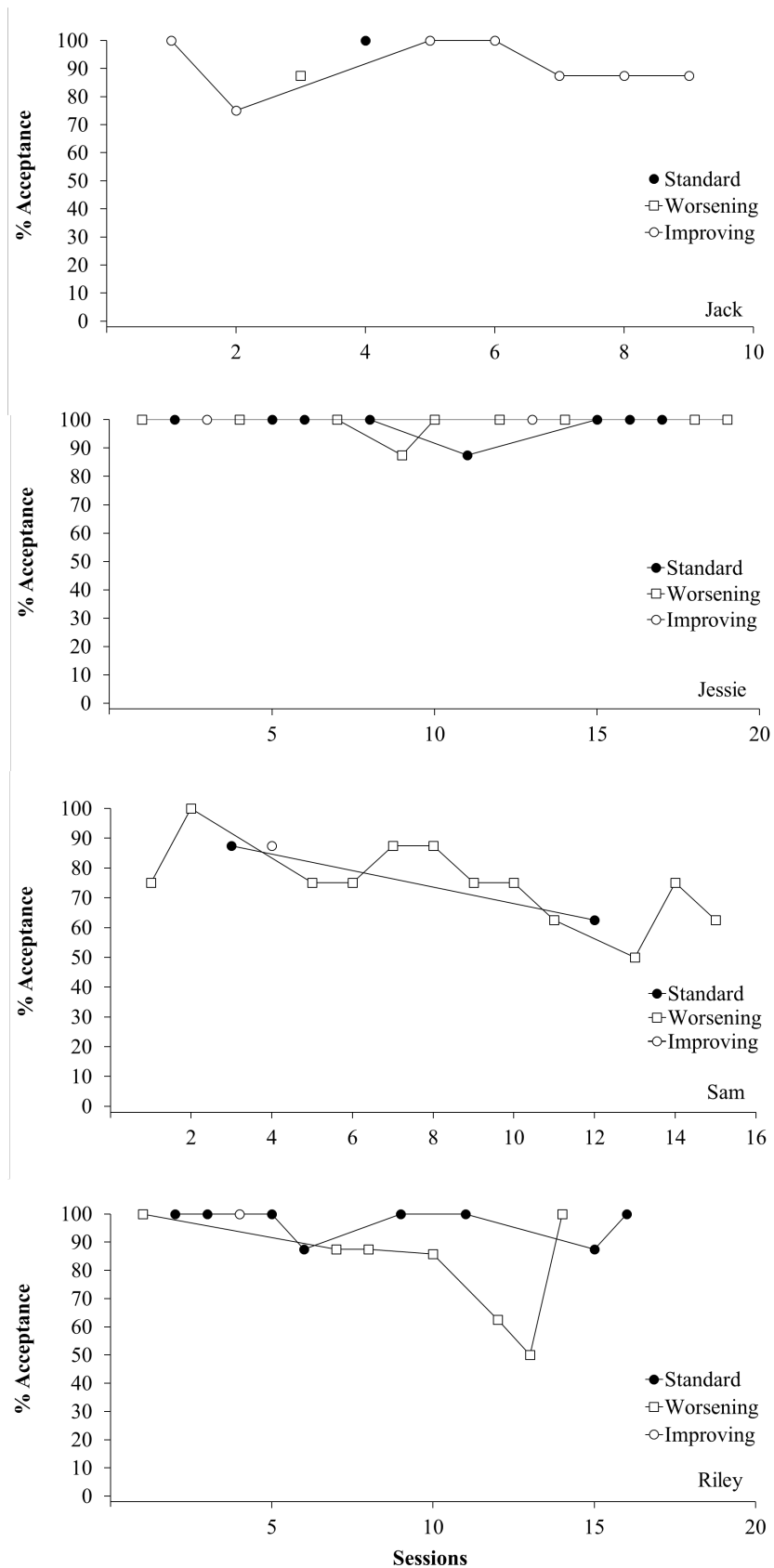
Table 3

Mean Latency to Bite Acceptance and Mean Responses per Minute of Inappropriate Mealt ime Behavior

Participant	<i>M</i> Latency to Acceptance (s)			<i>M</i> IMB (rpm)		
	Standard	Worsening	Improving	Standard	Worsening	Improving
Jack	6*	4.88*	5.63	0*	0*	0
Jessie	2.42	2.35	2.38	0	0	0
Sam	4.88	4.72	3.75*	0	.11	0*
Riley	3.31	4.8	3.375*	0	.13	0*

Note: IMB = Inappropriate Mealt ime Behavior, s = seconds, rpm = responses per min. Values with an * represent those from a single session, and are therefore, not mean values.

Figure 2. *Acceptance in the terminal-link of the concurrent-chains preference assessment.*



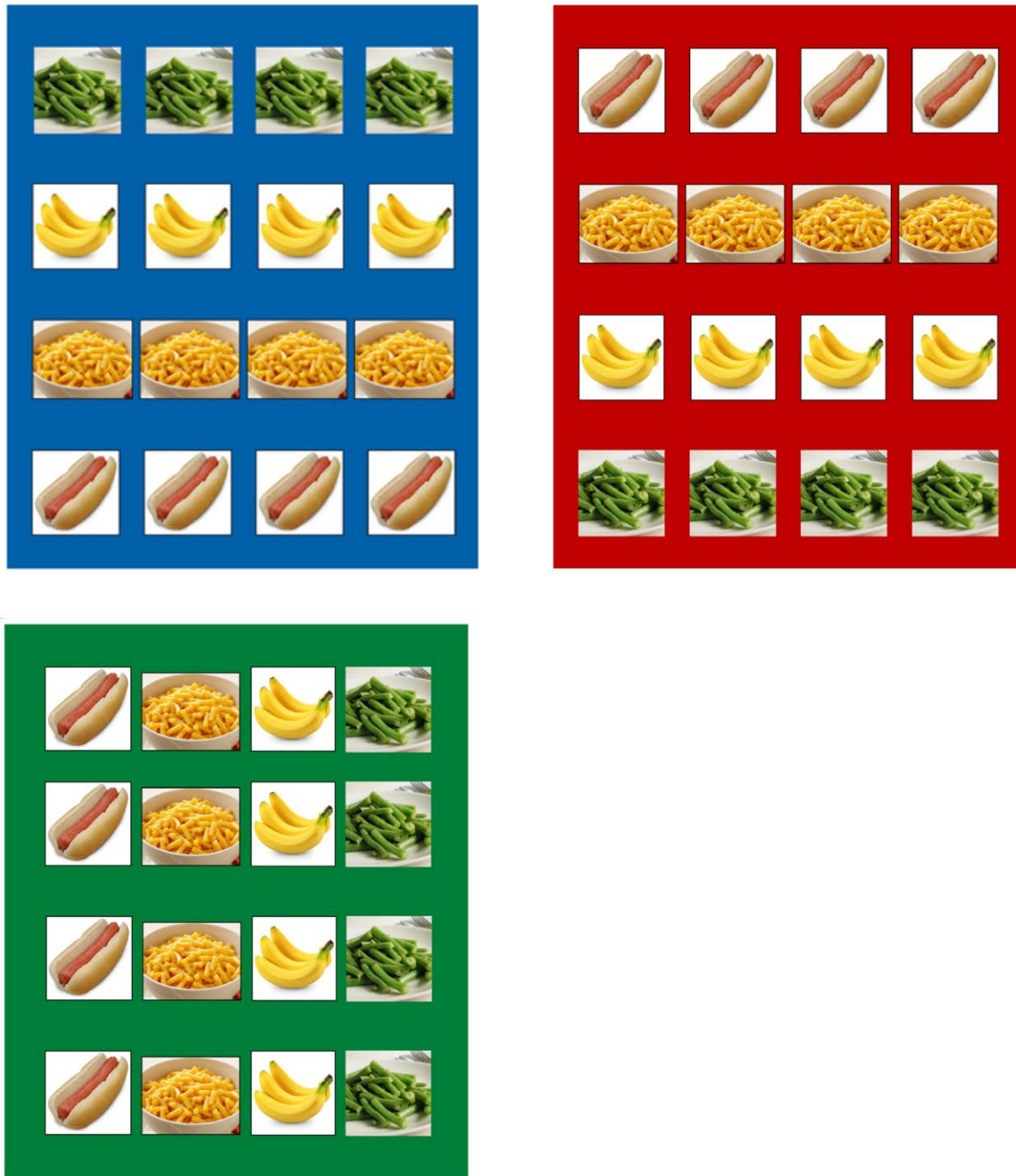
Supporting Information

Figure A1. Example colored poster boards depicting the improving (blue), worsening (red), and standard (green) sequences. In this example, green beans are the nonpreferred food, banana is the low-preferred food, macaroni and cheese is the moderately-preferred food, and hot dog is the high-preferred food.