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**Save the Best for Last II: Whether One Saves the Best for Last
Depends on Outcome Category**

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Abstract

Usually, people prefer immediate over delayed outcomes. As such, when arranging outcomes, one could assume a person would prefer to start with the best outcome and end with the worst outcome. Nevertheless, people typically exhibit negative time preference (i.e., they prefer an improving series of outcomes) when the choice involves a sequence of outcomes. The generality of this finding was assessed across types of stimuli and populations. In Study 1, we examined the correspondence between college students' preference for the order in which they experienced sequences of categorically-different outcomes when those were hypothetical versus real. There was very strong correspondence in the ranks assigned to the hypothetical and real outcomes, but more variability in the sequences generated. In Study 2 we aimed to determine preschoolers' preference for sequences. With academic items, 2 of the 4 participants chose to save the best for last. With leisure items, none of the participants saved the best for last. Preschoolers generally interspersed more- and less- preferred activities.

Keywords: negative time preference, positive time preference, preference for sequences, categories, save the best for last.

Save the Best for Last II: Whether One Saves the Best for Last Depends on Outcome Category

Delay discounting studies have found that in choice paradigms where only one outcome is selected from an array, delayed outcomes are generally valued less than immediate ones (Ainslie, 1975). Specifically, *delay discounting* refers to a decrease in the value of a reward when it is delayed compared to when it is immediately available (Odum, 2011). Delay discounting studies often involve hypothetical choices of 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. In economics, this diminished value of delayed outcomes relative to those that are not delayed, or alternatively, preference for present versus future consumption is referred to as *positive time preference* (Olson & Bailey, 1981).

There is evidence to suggest, however, that time preference may depend on the choice paradigm. Results of several studies have suggested that when a choice is viewed as being part of a sequence of outcomes, people typically exhibit *negative time preference* (i.e., they prefer an improving series of outcomes; Loewenstein & Prelec, 1991). Notably, *negative time preference* refers to a preference for future over immediate consumption of the more preferred option, or a general preference for improvement, which can manifest in a perfectly improving sequence or in a sequence that simply ends with the most preferred option. In the Loewenstein and Prelec (1991) study, for example, when the choice was between eating at a more preferred restaurant in one month or in two months, 80% of participants preferred the sooner option (i.e., they exhibited positive time preference). When the choice involved 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). The existing research shows that the framing of the choice affects how people behave (Tversky & Kahneman, 1981). More specifically, when the question frame draws attention to individual components of the choice (e.g., would you like to spend time with your friends now or later?), people tend to exhibit positive time preference (Frederick et al., 2002); when the decision frame draws attention to the sequential aspect of the choice, or a series of unavoidable outcomes (e.g., you are able to choose the order in which you complete your work assignment and spend time with friends; which would you like to do first?), people tend to exhibit negative time preference (Loewenstein & Prelec, 1991).

In addition to the framing of the choice, other factors are relevant to time preference. Two factors that have been demonstrated to have an impact on preference for sequencing are outcome category and real versus hypothetical outcomes. Outcome category refers to specific characteristics of the outcome (e.g., pleasurable, or aversive outcomes, an experience, or a material purchase); whereas real versus hypothetical refers to whether the outcomes are just imagined or experienced.

Though there is considerable evidence to support preference for categorically different outcomes (see Castillo et al., 2022), little is known about the correspondence between people's choices of real versus hypothetical *experiential* outcomes. Studies on delay discounting using real and hypothetical *monetary* rewards have found no significant differences in responding as a function of reward type (Lagorio & Madden, 2005; Locey et al., 2011; Madden et al., 2003). Nevertheless, studies on correspondence between real and hypothetical choices using methods other than delay discounting tasks have found discrepancies when choices involve moral decisions (FeldmanHall et al., 2012), consumer goods purchases (Kang et al., 2011), or strategic

social interactions (Vlaev, 2012). Moreover, recent studies have found differences in risk-taking behavior and neurological activity when the rewards involved large magnitudes of hypothetical or real money (Xu et al., 2018), with participants taking less risks with increased magnitudes of real money, but not changing their risk-taking behavior with increased magnitudes of hypothetical money. Therefore, there are contradictory findings regarding correspondence between real and hypothetical choices, and this difference may be more pronounced when the outcomes involve things other than small amounts of money. As discussed in Castillo et al. (2022), Andrade and Hackenberg (2012) compared preference for sequences using two different preparations: one involving questionnaires and the other repeated choices involving access to real consumable reinforcers (i.e., video clips). Nevertheless, the outcomes in both preparations varied in more than one aspect, in addition to the framing of the choice: the category and whether the outcomes were real or hypothetical. We do not know if preference for sequences of categorically-different outcomes will remain constant when the same outcomes are real versus hypothetical.

Finally, there are no known published studies of preference for sequences with children. To date, most published studies have evaluated preference for sequences with young adults, with only a few studying this phenomenon with older adults (e.g., Löckenhoff et al., 2019). Age differences have been observed in delay discounting, with children discounting future rewards at a greater rate than adults (Green et al., 1994). If sensitivity to delay changes throughout the lifespan, it is possible that preference for sequences, specifically for delaying gratification by generating improving sequences, or saving the best for last, may also strengthen with development. Given the lack of research with children in this area, we do not know whether preschool children will also exhibit negative time preference when asked to schedule sequences

of outcomes.

Two studies were designed to answer the following questions: (a) does the likelihood of saving the best for last differ when the sequences involve noxious experiences, food, leisure items, schoolwork, exercise, or a mix of all categories? (b) is there correspondence between college students' preference for sequence order when outcomes are hypothetical versus real? and (c) will typically-developing preschool children also choose to save the best for last when scheduling sequences of school tasks, food, exercise, stories, leisure activities, or a mix of all categories?

Study 1: Correspondence Between Sequence Preferences of Hypothetical and Real Outcomes

The purpose of Study 1 was to determine whether there was correspondence between college students' preference for sequences when the sequences involved hypothetical and real outcomes. The language used to reflect the choice in this study is consistent with that of Castillo et al. (2022) and reflects a style that is expected to consistently occasion negative time preference. The rationale for this choice of language was to be consistent with prior studies on preference for sequences and to minimize changes and manipulations to variables that we know could affect choice. Specifically, in the current study the variables manipulated were outcome category and type (i.e., real versus hypothetical). Specifically, we aimed to determine whether time preference and the likelihood of saving the best for last differed when the sequences involved hypothetical or real school tasks, food, leisure activities, noxious stimuli, exercises, or a mix of all the categories. If there is correspondence, then one can be more confident when interpreting results of studies of time preference using hypothetical outcomes. If time preference differs when the outcomes are real versus hypothetical, then one will need to exercise caution

when drawing conclusions on real human decisions from hypothetical studies of intended behavior.

Method

Participants, Consent, Setting, and Materials

Four men and four women between 18 and 24 years of age participated in Study 1. Participants were recruited from undergraduate psychology courses and invited to participate in the study via a psychology participant pool, for extra credit and a chance to win a \$25 Amazon gift card. To minimize undue influence, none of the participants were current students of the experimenters. During the consent meeting, participants were informed of health-related matters that could place the individual in harm in a cold-pressor task, including pulmonary hypertension, history of high blood pressure, diabetes, stroke, and Raynaud's disease. Before participants signed the consent form, they were asked to complete the Evaluation to Sign Consent, which consisted of several questions to ensure participants understood the consent form and research protocols. Upon correct completion of this evaluation, the consent forms were signed. Any participants who reported having any of the aforementioned health conditions would be excluded from the noxious and mixed categories but could continue to participate in the remainder of the study, if they choose to do so. This was never the case, however, as none of the participants reported having any of those health conditions. Following consent, participants were asked to select five foods from a list and note any potential allergies or dietary restrictions. They were also asked to bring their cell phone to session and to dress comfortably enough to engage in light physical exercise. Sessions were conducted in a laboratory space at the university, with a table, a computer, and all category-specific materials. In the sessions involving real outcomes, there were five laminated cards depicting numbers one through five for participants to use when ranking the

items in the list. Materials necessary to complete the activities in each category were present. In all sessions, there was a timer that the experimenter used to keep track of activity duration as well as pencils and paper data sheets for data collection. This research project was reviewed and approved by the UMBC Institutional Review Board.

Procedures

Overview. Participants were asked to come to the laboratory for two sessions. In an attempt to control for variables that could be responsible for the discrepancy in responding to hypothetical versus real outcomes, participants were given brief exposure to all outcomes before answering the hypothetical survey. As such, if there were differences in responding, they would not be because the participants did not understand in the hypothetical survey what the experience would be like. Therefore, in the first session, which lasted approximately 30 min, participants had brief exposure to all the items that would be used in the rest of the study and completed the survey of hypothetical outcomes. In the second session, which lasted approximately 2 hr, participants ranked and generated sequences in which they would like to experience real outcomes and completed an exit survey. Session 2 was completed no more than two days after Session 1. Six participants completed both sessions consecutively, with a brief break in between. One participant completed both sessions in consecutive days (i.e., Session 1 in the afternoon, Session 2 in the following morning), and one participant completed both sessions two days apart (i.e., Session 1 on Monday and Session 2 on Wednesday).

Session 1. Participants sampled all items or activities for all categories, with up to 30 s access to each item. Duration of pre-exposure to an item or activity was never greater than the

duration of the exposure during the actual test conditions. That is, if the exposure in the test condition was 5 s (e.g., cold-pressor task), then the pre-exposure was also limited to 5 s.

Following pre-exposure, participants completed the Qualtrics Sequence Survey from Castillo et al., (2022) Study 2, on a laboratory computer. Given that in the current study participants would actually experience selected outcomes, for health, religious, or dietary concerns, the list of food items was edited such that only the items that were pre-selected or approved by the participant at the time of enrollment were included. All other categories remained the same.

Session 2. In the second session, participants completed the leisure, noxious, exercise, food, and work categories in a randomly assigned order first, and ended with the mixed category. Because the mixed category consisted of the top-ranked item from each of the other categories, the mixed category had to be completed last. For each category, all items were displayed on the table and participants were shown each item briefly. Participants were then asked to rank their preference for each option, by placing the corresponding number card in front of each alternative (1 = highest preferred; 5 = least preferred). The experimenter then stated: “For the next [condition specific amount of time], you will have [specific time] to do each of these activities. Please tell me in what order you would like to do them.” The experimenter wrote down the sequence and showed it to the participant to confirm the desired sequence. If there were any errors in the recording of the preferred sequence, participants were given one opportunity to modify the sequence at this time. Once the preferred sequence was confirmed, the experimenter gave the materials for the first activity to the participant and started the timer for the appropriate duration.

Leisure category. Leisure activities were presented, in the order selected, for 5 min each.

When the 5 min elapsed with the first activity, the experimenter stated “Time is up. You now have 5 minutes to do [the next activity]” and removed the items for the first activity and presented the items for the activity scheduled second. The last two steps were repeated until the participant experienced all activities.

Noxious category. Prior to initiating the session, all items were displayed on the table. The experimenter stated: “For the next few minutes, you will experience several annoying or slightly uncomfortable stimuli. These are used as part of standard neurological testing in clinical and research settings, as well as to assess pain sensitivity. Other than discomfort, or slight pain, there is no real risk to your health or well-being in experiencing these. In case you do not remember them from last session, I’ll show you what they look like, so you know what to expect.” Participants were shown each item, one at a time, as the experimenter briefly described how the item was used. Participants were then asked to rank their preference for each option. The experimenter then stated: “Over the next 2 to 5 minutes, you will experience five different events, each should take a few seconds, no more than 30 seconds. Please tell me in what order you would like to do them.” Once the preferred sequence was confirmed, the experimenter proceeded with the first scheduled stimulus followed by the next in the sequence until all five had been presented. Participants could refuse to experience any of the stimuli presented, however, this never occurred. Except for the cold pressor task, which involved the entire hand and part of the forearm, all other stimulations were applied to the front of the wrist, 2.5 cm from the palm. This spot is also less likely to have sweat which could affect the sensory experience. Specific procedures for each sensory experience are described next.

Pin prick. The experimenter applied a light pin prick to the inside of the wrist one time for less than 1 s, applied from 5 cm away with moderate force with a single-use plastic pin made

for use during neurological exams. The pin was designed not to break the skin.

Cold pressor task. The experimenter prompted participants to place a hand in a stainless-steel bucket with iced water (water temperature set to $3^{\circ}, \pm 1^{\circ}\text{C}$) one time for 5 s. The experimenter timed the 5 s using a stopwatch and prompted participants to remove the hand from the cold pressor when the timer expired.

Deep pressure. The experimenter applied the algometer (Wagner model FDX) to the participant's inner wrist and once the pressure display reached 1.8 kg, a 5-s timer was initiated. The experimenter removed the stimulus when the timer elapsed.

Repeated Von Frey. The experimenter applied the monofilament (60 g) against the participant's skin until the filament bent approximately halfway 30 times at 1 Hz, which is 30 times in 30 s for 1 s across applications in the same spot. The *repeated* Von Frey is used as a test of increased pain perception to a repetitive stimulus (Barney et al., 2015). The experimenter stated "on" when applying the first touch and the data collector started a 30-s timer. The rest of the 30 touches were silently counted by the experimenter (i.e., 1-Mississippi, 2-Mississippi, ..., 29-Mississippi, etc.) with each second being associated with a touch of the Von Frey monofilament to the skin. After 30 applications were complete, the experimenter said "off" to signal the end of the stimulus session, and the data collector stopped the timer. The data collector independently took data on the number of applications during the interval, to ensure integrity and calculate interobserver agreement (IOA).

Warm thermal probe. The experimenter touched the participant's inner wrist with an electronic thermal heat probe, heated to 50°C (122°F) one time for 5 s. The experimenter stated "on" upon contact of the probe with the participant's skin, timed the 5 s using a timer, and removed the stimulus when the timer elapsed.

Exercise category. Picture cards depicting the five different exercises were displayed on the table. The participant was shown each card and the experimenter reminded the participant how the exercise was performed by showing a brief video clip. Participants were then asked to rank their preference for each option. The experimenter then stated: “For the next 10 minutes, you will have 1 minute to do each of these exercises, with a 1-minute break in-between exercises. Please tell me in what order you would like to do them.” Once the preferred sequence was confirmed, the experimenter showed the picture card to the participant, stated “You have 1 minute to do as many [exercises] as you can” and started the 1-min timer. When the 1 min elapsed, the experimenter stated “Time is up. You can take a 1-minute break.” After the break, the experimenter stated, “You now have 1 minute to do as many [the next exercise] as you can” and presented the items (e.g., picture card, floor mat) for the exercise scheduled second. The last two steps were repeated until the participant had experienced all activities.

Food category. The items that were pre-approved by the participant during enrollment in the study were displayed on the table. The participant was shown each one briefly, one at a time. Participants were then asked to rank their preference for each option. The experimenter then stated: “You will now sample each of these. Please tell me in what order you would like to sample them.” Once the preferred sequence was confirmed, the experimenter administered a small sample of the first scheduled food to the participant. When the participant had consumed the food, the experimenter presented the next item. Participants could elect not to consume a food item; however, this never occurred.

Work category. All items were displayed on the table and the participant was shown each one briefly, one at a time. Participants were then asked to rank their preference for each option. The experimenter then stated: “For the next 25 to 30 minutes, you will have 5 minutes to

work on each of these activities. Please tell me in what order you would like to do them.” Once the preferred sequence was confirmed, the experimenter stated: “complete this as if it were a school assignment for which you would be graded. Do your best work,” provided the materials for the first scheduled activity to the participant and started the 5-min timer. When the 5 min elapsed, the experimenter removed the materials for the current activity and said “Time is up. You now have 5 minutes to work on [the next activity]. Complete this as if it were a graded school assignment. Do your best work,” and presented the items for the activity scheduled second. These steps continued until the participant had experienced all activities.

Mixed category. Outside of the laboratory, choices and daily schedules often involve a mix of activities of different categories. Therefore, the last category involved a mixed category, in which the top-ranked items from each of the preceding five categories were included. At the start of session, all items were displayed on the table and the participant was shown each one briefly, one at a time. Participants were then asked to rank their preference for each option. The experimenter then stated: “For the next few minutes, you will experience each of these options. Please tell me in what order you would like to experience them.” Once the preferred sequence was confirmed, the experimenter administered the materials for the first scheduled item to the participant. If it was a leisure or work task, the experimenter started the 5-min timer. If it was exercise, the experimenter started a 1-min timer. When the participant consumed the food, experienced the noxious stimulation, or when the timer elapsed, the experimenter said “Ok. You are all done with [activity]. You now get to [perform next activity]” and presented the items for the activity scheduled second. These steps continued until the participant experienced all activities.

Data Collection and Interobserver Agreement

For hypothetical outcomes, ranks for each item in the list and preferred sequence order were collected directly through the Qualtrics Sequence Survey. Pilot testing was conducted to ensure the Qualtrics data output matched participant responses.

For sessions involving real outcomes, two observers independently collected data during all sessions and used paper data sheets to record the ranks assigned to each item on the list as well as the sequence generated by the participant, and whether the participant requested changes to the sequence. For food items, data were collected on consumption or refusal of each item. For noxious experiences, data were collected on experimenter behavior (i.e., whether the experimenter implemented the stimuli as indicated), and participant behavior, specifically, completion of the experience or refusal. IOA for rank, sequence generated, food consumed, and experience, refusal, and integrity of noxious experiences was calculated by dividing the number of agreements by the number of agreements plus disagreements. There was 100% agreement across all the aforementioned measures. Engagement data were collected using 10-s momentary time sampling for leisure and schoolwork, and 5-s momentary time sampling for exercise. Specifically, the observation time was divided into 10-s (or 5-s) intervals, and observers recorded whether the participant was engaging with the activity at the end of the 10-s (or 5-s) interval (Becraft et al., 2016). Because the exercise duration was 1 min, the sampling intervals were reduced to allow for more observations. Engagement was defined as the participant holding the materials and manipulating them in a manner as it was intended (i.e., not just resting a hand on them), or the participant attempting to complete the activity, even if incorrectly. Interval-by-interval IOA for engagement with the outcome was calculated by adding the number of intervals with agreements and dividing it by the total number of intervals in the observation period

(Becraft et al., 2016). Across participants, mean IOA for engagement in each category was 99.8% (range, 98% – 100%) for leisure, 99.6% (range, 96.7% – 100%) for exercise, 99.9% (range, 99.3% – 100%) for schoolwork, and 99.7% (range, 98.6% – 100%) for the mixed category.

Results and Discussion

How do categorical features of items in an array influence saving the best for last and general sequence preference? For each sequence category, the researchers calculated the number of participants who chose the top-ranked option last or first in the sequence, as well as a Spearman rank order correlation between the relative value of the outcome, determined by the rank assigned by the participant, and the order in which it was selected. This correlation was intended to capture individual variations in sequence preferences and is appropriate for rank data. The resulting scores could range from -1 (perfectly improving, rank is inversely related to position in sequence) to 1 (perfectly worsening, rank is directly related to position in sequence) with scores closer to zero indicating a preference for interspersing higher and lower preferred outcomes. Results of these analyses are depicted in Table 1, separated by participants, and summarized for the entire sample. In general, participants were more likely to schedule the best first than last, except for real noxious outcomes, and hypothetical mixed sequences. For real leisure outcomes, an equal number of participants scheduled the best first or last. The greatest number of participants who saved the best for last (i.e., half of the sample) was observed with noxious stimuli when those were real. No participants saved the best for last when scheduling hypothetical exercises. Except for leisure and mixed categories, more participants saved the best for last when the outcomes were real rather than hypothetical. Given that all participants responded to the survey of hypothetical outcomes first and then the real outcomes, it is possible

that the sequence of exposure can account, to some extent, for the fact that saving the best for last was never less likely with real outcomes than it was with hypothetical outcomes.

What degree of correspondence is observed in responding to hypothetical or real outcomes? For each participant, the researchers calculated a Pearson correlation between participant's ranks of hypothetical outcomes and their ranks of the real outcomes. Similarly, the researchers calculated a Pearson correlation between the sequences generated for hypothetical outcomes and those of the real outcomes. The results of the correspondence analysis for ranks and sequences are depicted graphically in

Figure 1 as the percentage of responses that had a strong positive correlation (defined as $r \geq .6$), a weak positive correlation ($.5 \leq r < .6$), no correlation ($-.1 \leq r < .5$), a weak negative correlation ($-.2 \leq r < -.1$), or a strong negative correlation ($r \leq -.6$). Overall, there was very strong correspondence in the ranks assigned to the hypothetical and real outcomes, suggesting that people's relative preference for outcomes is consistent. All participants engaged with all the items or activities throughout the duration of the interval and consumed all the foods presented, therefore, engagement and consumption data were not used in further analyses.

There was greater variability in the correlations between the sequences generated, which suggests that although rank may be constant across type of outcome and time of response, sequence preferences may be more variable. It is important to note that in the current study, participants responded to the surveys just once. Furthermore, during the exit survey, one of the participants stated that she would have scheduled activities differently were she to do it again. Future studies could conduct repeated measures and compare consistency across measures and

correspondence between responses to hypothetical and real outcomes given repeated opportunities to respond.

Study 2: Outcome Category as a Predictor of Preschooler's Time Preference

Prior studies have found that children's preference for delayed rewards increases with age, with kindergarten children being the least likely to select a larger later reward over a smaller sooner reward, compared to elementary school children (e.g., Mischel & Metzner, 1962). In studies of delayed gratification, in which children can obtain a less preferred reward immediately or continue waiting indefinitely for a more preferred reward, considerable variability is often observed in the amount of time preschool children voluntarily delay gratification (e.g., Mischel et al., 1989).

Given the lack of studies on children's preference for sequences, it is unclear whether negative time preference, or saving the best for last, emerges along a developmental path that parallels the development of self-control (e.g., Mischel & Mischel, 1983). Although delay of gratification may be less likely with preschoolers, it is possible that framing the choice as a sequence may function as a strategy that promotes saving the best for last. The purpose of this study was to determine whether typically-developing preschool children also choose to save the best for last and whether the likelihood of exhibiting negative time preference differs when the sequences involved school tasks, food, exercise, books, leisure activities, or a mixed category.

Method

Participants, Setting, and Materials

Four typically-developing preschoolers participated in Study 2. Participants were recruited from a preschool in the mid-Atlantic region. Cole and David were 4.5 years old at the time of the study and were in the four-year-old classroom. Andrea and Carla were 5 years old at

the time of the study and were recruited from the five-year-old classroom. Sessions were conducted in a quiet room in the preschool (i.e., the staff lounge) furnished with two chairs and a table. Session materials included a timer and the materials relevant to specific categories. Additionally, there were picture cards depicting each of the activities or items in the different categories that participants used to create a visual schedule when generating their preferred sequence order. Session procedures were explained to caregivers and teachers at the time of recruitment and consent, and all agreed that the participants would be able to organize and understand a visual schedule. Items for the different categories were selected in consultation with the preschool director, preschool teachers, and parents. The work category included tracing or coloring sheets, a lacing task, a shape identification task, a counting task, and a letter identification task. The food category included items that were pre-approved by the participant's parent or guardian and included blueberries, fruit snacks, veggie straws, carrots, yogurt, chips, and crackers. The leisure category included a bin with uncooked pasta for children to play with, Lego Duplos[®], costumes for pretend play, Incredibles figurines, and Play-Doh[®]. The story-time category included five different children's story books. The exercise category included an exercise mat and a hula hoop.

Procedures

General procedures. During the informed consent process, parents were asked to disclose if their child had any food allergies. Parents were given a list of the foods that could be used during session, so they could indicate their acceptance of the food choices and write down any additional recommendations.

Participants were asked to take part in seven sessions, lasting 5 to 30 min each. The first session was used to build rapport with the participant, and to give the participant exposure to the

different items and activities that would be used throughout the study. During that first meeting, a brief delay sensitivity assessment was conducted. Specifically using a Hershey's kiss, which had been identified by the caregivers as highly preferred, the experimenter told the participant: "We have a chocolate for you. Do you want this chocolate now or later, in about 3 minutes?" If the participant selected "now," the item was delivered immediately, and the assessment ended. If the participant selected "later" the experimenter started a 3-min timer and said "OK, you chose in 3 minutes. You can have your chocolate when the timer beeps." When the 3-min timer elapsed, the experimenter delivered the chocolate to the participant, and then repeated the procedure two more times, for a total of three trials. The purpose of the delay sensitivity assessment was to verify that given a single-outcome choice, all participants' choice would be as expected and reflect positive time preference (i.e., that participants would prefer an item immediately, rather than the same item following a delay). Additionally, the delay sensitivity assessment allowed the researchers the opportunity to further gauge whether the participants could respond to questions and instructions.

Each of the remaining six sessions assessed a different category. Prior to starting, the order of the categories was randomized, but the mixed category was always last. In each session participants (a) generated a preference rank hierarchy in a paired-choice format, (b) generated a preferred sequence with a visual schedule, and (c) experienced all the activities in the scheduled order.

Preference ranking. At the beginning of session, the participant was given brief (approximately 5 s) exposure to each activity while the experimenter paired it with the corresponding picture card. Following pre-exposure, the experimenter stated: "I want to get to know you a little better and see what you like. I will show you a few things, and I want you to

tell me which one you like the most. We will get to do these in a little while.” Participants then completed a modified paired-stimulus preference assessment (PSPA, Fisher et al., 1992), explained next, with the picture icons that represented the actual materials. For each possible pairwise combination, participants were asked: “which of these do you like the most [item x] or [item y]?” Once identified, the experimenter said “Okay, so you like [item] more than [other item]” then moved on to the next pair. Following selection, participants could hold the picture card briefly, but did not get access to the items during the modified PSPA. Although not providing immediate access to the selected item is atypical in a PSPA, it has been successfully carried out in the past with children with and without high-functioning autism (Goldberg et al., 2017). Restricting access during the PSPA was intended to minimize satiation with the items, which could later affect how the participant generated a preferred sequence. Furthermore, only one round of the PSPA was conducted, for a total of 10 trials, making the entire assessment relatively brief.

Preferred sequence. Once a hierarchy was identified, participants were asked to generate a sequence by placing the picture icons on a visual schedule, in the order in which they would like to experience them. The experimenter stated: “For the rest of our time together, we get to [do, read, or eat] all these. Let’s create our own schedule. What do you want to do first? Put the picture card at the top of the schedule board...What do you want to do second?” and so on. Once all the cards had been placed on the schedule, the experimenter verbally described the schedule order, “Okay, you said you want to [perform activity] first, then [next activity]” and so on. At this point, the participant could agree to the schedule, or choose to change it one time. The participants then completed the activities for the corresponding category, as described below. Participants were encouraged to engage in an activity throughout the duration. If the participant

stopped engaging in the activity, the experimenter continued to provide verbal prompts or statements of encouragement until the timer elapsed. At the end of each session, participants were given a small sticker. Following completion of the study, participants were given a small thank-you gift (e.g., a book, bubbles) that was up to \$10 in value.

Leisure and work categories. The experimenter pointed to the first icon on the schedule and said “Okay. We will be starting with [activity].” The experimenter then gave the materials for the first activity to the participant and started the 2- to 4-min timer. The duration of access to the activities was 4 min for all participants, except for David’s work category. Academic activities were reportedly very aversive to David, therefore, to minimize the chances of making the whole experience very aversive, the duration of the academic activities was restricted to 2 min for him. When the timer elapsed, the experimenter said “Okay, we are all done with [activity]. You can place the picture icon in the ‘all done’ pocket” and removed the materials for the first activity. The experimenter then said “Next, we have [next activity]” and presented the items for the activity that was placed second in the sequence. These steps continued until the participant had experienced all activities.

Story-time category. The experimenter pointed to the first icon on the schedule and said “Okay. We will be starting with [book],” and read the book with the participant. When the book was over, the experimenter said “Okay, we are all done with [book]. You can place the picture icon in the ‘all done’ pocket. Next, we have [next book],” and started reading the book that was scheduled second in the sequence. These steps continued until the participant had read all books.

Exercise category. The experimenter pointed to the first icon on the schedule and said “Okay. We will be starting with [exercise],” started a 30-s timer and engaged in the exercise along with the participant. When the timer elapsed, the experimenter said “Okay, we are all done

with [exercise]. You can place the picture icon in the ‘all done’ pocket. Next, we have [next exercise],” and prompted the participant to do the exercise that was scheduled second in the sequence. These steps continued until the participant had performed all exercises.

Food category. The experimenter pointed to the first icon on the schedule and said “Okay. You get to eat [food],” and gave a small piece of the first food to the participant. When the participant had consumed the food, the experimenter presented the next item. These steps continued until the participant had sampled all foods.

Mixed category. The top-ranked items from each of the preceding categories were included. The experimenter pointed to the first icon on the schedule and said “Okay. We will be starting with [item].” The experimenter gave the materials for the item to the participant. If it was a leisure or work task, the experimenter started 4-min timer (or a 2-min timer for David’s work task). If it was an exercise, the experimenter started the 30-s timer. When the participant had consumed the food, the experimenter has finished reading the book, or when the timer elapsed, the experimenter said “Okay. We are all done with [item].” The experimenter removed the materials and prompted the participant using the following phrase “You can place the picture icon in the ‘all done’ pocket. Next we have [activity].” The experimenter then presented the items for the second scheduled activity. These steps continued until the participant had experienced all activities.

Data Collection and Interobserver Agreement

Observers used paper data sheets to record selection during the PSPA and the sequence generated by the participant. Observers recorded how much time it took participants to generate a sequence (from initial prompt until the last picture card was placed on the schedule), and whether the participant choose to change it when give the option (prior to experiencing any of

the activities). For food items, data were collected on consumption or refusal of each item. Engagement data were collected using a 10-s momentary time sampling for leisure, story time, and schoolwork, and 5-s momentary time sampling for exercise. Specifically, the observation time was divided into 10-s (or 5-s) intervals, and observers recorded whether the participant was engaging with the activity at the end of the 10-s (or 5-s) interval (Becraft et al., 2016). Because the exercise duration was just 30 s, the sampling intervals were reduced to allow for more observations. Engagement was defined as the participant holding the materials and manipulating them in a matter as it was intended (i.e., not just resting a hand on them or touching them to throw across the room; Keen & Pennell, 2010; Peters & Thompson, 2013), or the participant attempting to complete the activity, even if incorrectly. For story time, engagement was scored when the participant was facing the book or talking about the story. A second observer independently collected data during 100% of sessions across phases and participants. Observers also collected data on integrity, specifically, they noted if the correct item was provided when required. IOA for the PSPA, sequence generated, and food consumed was calculated by dividing the number of agreements by the number of agreements plus disagreements. There was 100% agreement on selection in all PSPA sessions for all participants. There was also 100% agreement in all sessions and for all participants regarding the sequence generated, whether the participant requested to change the sequence when given the option, food consumption, and integrity. Similarly, interval-by-interval IOA for engagement with the outcome was calculated by adding the number of intervals with agreements and dividing it by the total number of intervals in the observation period (Becraft et al., 2016). Mean IOA for engagement included 95.5% (range, 90.0% – 100%) for Cole, 99.5% (range, 98.7% – 100%) for Andrea, 89.3% (range, 69.2% – 100%) for David, and 100% for Carla.

Results and Discussion

During the delay sensitivity assessment, Cole, David, and Carla selected the immediate option on the first trial. Andrea selected the delayed option (i.e., the same Hershey's® Kiss following a 3-min delay) in the first trial, while clarifying “because my mommy said I have to wait.” Following the delay, she was given access to the Hershey's® Kiss. In the two subsequent trials, she selected the immediate option both times. Results of the delay sensitivity assessment suggested that our participants could discriminate between the delayed and immediate options, and that, they exhibited positive time preference in this scenario, preferring immediate over delayed consumption. Results of the sequence preference evaluation are depicted in Table 2 and will be discussed next in the context of two specific questions.

How do categorical features of items in the array influence saving the best for last?

This question was answered by specifically looking at whether participants saved the best option for last in their sequence for each category (see “STBFL” rows in Table 2). When the sequence involved academic-type activities, two of the participants (Cole and Carla) scheduled the best for last. When the sequence involved exercise, story time, food, or a mix of all the categories, Carla was the only one of the four participants who saved the best for last. None of the participants saved the best for last when the sequence consisted exclusively of leisure items. Conversely, in almost all categories (food category excluded), half of the participants chose to schedule their favorite activity first (see “Best First” rows in Table 2). Overall, in 11 of the 24 sequences, the best activity was scheduled first, whereas the best was saved for last in 6 of the 24 sequences.

How do the categorical features of items in an array influence sequence preference?

For each sequence category we calculated a Spearman rank order correlation between the relative value of the outcome, determined by the rank assigned by the participant, and the order

in which it was selected. This correlation is intended to capture individual variations in sequence preferences and is appropriate for rank data. The resulting scores range from -1 (perfectly improving, rank is inversely related to position in sequence) to 1 (perfectly worsening, rank is directly related to position in sequence) with scores closer to zero indicating a preference for interspersing higher and lower preferred outcomes. The correlation coefficients are shown in the third row for each sequence category in Table 2. Results for individual participants are depicted in their respective columns, with the results for the entire sample depicted in the summary section on the right. Although in five of the six categories at least one participant chose to schedule the best option last, none of the participants generated a perfectly improving sequence. Preference for generally improving and worsening sequences varied across participants and most categories.

When the sequences involved academics, story time, food, and exercise, participants for the most part chose to intersperse more preferred activities with less preferred activities. Furthermore, in the mixed category, three of the four participants generated generally worsening sequences, and one participant -Carla- generated a mixed sequence with the first four scheduled activities going from more to less preferred (i.e., perfectly worsening), but saving the best activity until the end, or fifth in the sequence (hence, $r_s = 0$). In the leisure category, however, all participants generated generally worsening sequences ($r_s > 0$). Therefore, interspersing more- and less-preferred activities seems most likely with academics, story time, food, and exercise. Preference for interspersing, but generally worsening sequences seems likely with mixed sequences. Preference for worsening sequences or experiencing the most preferred sooner seems most likely with leisure items.

General Discussion

We investigated how young adults and preschool children choose to schedule outcomes of different categories. In Study 1, half of the participants saved the best for last when scheduling *real* noxious stimuli. Results of Study 1 suggest that this preference for sequences, or saving the best for last, may not be as robust as previously indicated, but this conclusion is a result of the specific procedures used in this study. Correspondence between responses to hypothetical or real outcomes was generally strong for preference ranks, but more variable for sequences generated. It makes sense that relative preference for outcomes remains constant in the short term, even if the scheduling preference changes from moment-to-moment.

To our knowledge, preference for sequences had not been evaluated with preschoolers before. Although there is reason to believe, as was supported by our findings, that preschoolers will want their preferred items and activities sooner, one of four participants chose to save the best for last in all categories, except for the leisure. The authors recognize that given the size of the sample one cannot make generalizing conclusions. Nevertheless, the “save the best for last” phenomenon *was* documented despite having included only four children.

The aim of Study 1 was to determine whether there is correspondence between participants’ choices involving hypothetical versus real outcomes, and in doing so, to aid in determining whether results of hypothetical questions can be valid. Nevertheless, procedural differences across studies cannot be ignored. For example, Study 2 of Castillo et al. (2022) was the most similar to the hypothetical survey experienced in the current Study 1, save for two differences. In the latter, participants answered the survey on a laboratory computer and, most importantly, participants had brief exposure to all the outcomes *prior* to responding to the survey. Although the two studies were nearly identical, these two differences cannot be ignored.

Furthermore, procedural differences with other hypothetical surveys should also be considered before making assumptions about the validity, or lack thereof, of the results.

In Study 1, we inferred preference based on the sequences participants generated prospectively. That is, following exposure to the different outcomes, participants generated a sequence, and had to commit to the order at the onset of the session. Because we did not provide a list of predetermined sequences to choose from, or experience, one cannot say anything about the relative preference for one arrangement, or sequence order, over another. Moreover, we did not ask participants to retrospectively evaluate the sequences experienced because in the current study there was no relative comparison (i.e., participants only experienced the sequence they generated). Nevertheless, research on retrospective evaluations of experiences extended across time suggests that evaluations of experiences are heavily influenced by the average of the peak (e.g., worst) and end (i.e., final) moments of the experience (Kahneman et al., 1993). Therefore, findings from prospective or retrospective evaluations of sequences may indicate a general preference for improvement. Consequently, even if the overall pain experienced would not differ, individuals undergoing painful medical treatments may prefer treatments that are ordered in a way such that the pain diminishes over time, rather than gradually increases, and their memory of the treatment may be less aversive if relief from the pain is gradual rather than abrupt (Kahneman et al., 1993). In Study 1, half of the participants saved the best for last when scheduling noxious stimuli, and at least one participant stated in the exit survey that if she were to do it again, she would have scheduled it from least to most preferred. The fact that young adults exhibit negative time preference with noxious outcomes may be worth noting when scheduling medical interventions within a single session. This consideration is important because it is possible that retrospective subjective evaluations of a medical appointment or intervention

could influence a person's morale or even compliance with follow-up appointments and future treatment recommendations. This could all subsequently affect medical outcomes (Redelmeier & Kahneman, 1996). Of course, further extensions are necessary to determine if these things would occur.

One limitation of the current studies is that participants ranked and generated sequences only once per category or type of outcome. It is possible however, that results would have differed with repeated measures. The authors believe there are many possible investigations that could be conducted regarding preference for sequences. For example, future studies could evaluate (a) response patterns when participants can generate sequences multiple times, (b) retrospective evaluations of sequences, when those are generated by the participants or by the experimenter, and (c) whether experiencing sequences in a preferred order is also associated with changes in performance during the different activities.

Finally, the current series of studies investigated whether college students and typically developing preschoolers save the best for last when scheduling sequences of categorically-different outcomes. Saving the best for last was observed across both age groups, even if to a smaller degree than has been reported in prior research. Furthermore, outcome category does seem to influence the percentage of participants who saved the best for last. One question that has not been answered yet is whether individuals with intellectual and developmental disabilities will also save the best for last when presented with an array of items with which to engage. The opportunity to choose the order of exposure is embedded in preference assessment procedures commonly used for individuals with intellectual and developmental disabilities (e.g., the Multiple Stimulus Without Replacement, DeLeon & Iwata, 1996, and the free operant preference assessment, Roane et al., 1998). The item selected first in these assessments is often incorporated

into behavioral programming to reduce problem behavior, increase appropriate behavior, or both. However, if individuals with intellectual and developmental disabilities are saving the best for last, then behavioral interventions may not involve the most preferred outcomes. At present, we do not know whether individuals with intellectual and developmental disabilities save the best for last when selecting items in a Multiple Stimulus Without Replacement arrangement (DeLeon & Iwata, 1996). The current study did not set out to answer this question, and given the procedural variations, attempting to do so with the current data would require a considerable interpretative leap. That is, in the current studies, participants were asked to select the order that they would experience stimuli at the onset of the assessment, whereas participants that complete MSWO preference assessments usually select the stimuli sequentially (not all at once). Nevertheless, this is an area worth further, and specific, study, given that an answer to this question could have meaningful implications for the way in which we conduct or interpret the results of preference assessments.

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Table 1

Saving the Best for Last, Scheduling the Best First and General Sequence Preference by Category and Type of Outcome for Study 1

	Participant																Summary	
	#1		#2		#3		#4		#5		#6		#7		#8		<i>f</i> (%)	
	HO	RO	HO	RO	HO	RO	HO	RO	HO	RO	HO	RO	HO	RO	HO	RO	HO	RO
Noxious																		
Best Last	0	0	1	1	0	0	0	1	1	1	0	0	0	1	0	0	2 (25)	4 (50)
Best First	0	0	0	0	1	1	1	0	0	0	1	0	1	0	1	1	5 (63)	2 (25)
<i>r_s</i>	-.6	-.2	-1.0	-1.0	.7	1.0	.9	-1.0	-.1	-.3	.7	-.2	.9	-1.0	1.0	1.0		
Leisure																		
Best Last	1	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	3 (38)	3 (38)
Best First	0	0	0	0	1	1	0	0	1	1	1	0	1	0	1	1	5 (63)	3 (38)
<i>r_s</i>	-.4	.3	-.9	.1	.9	1.0	-1.0	-1.0	1.0	1.0	.9	-.9	.8	-1.0	1.0	1.0		
Schoolwork																		
Best Last	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1 (13)	2 (25)
Best First	0	0	0	1	1	1	1	0	1	1	1	1	1	0	1	1	6 (75)	5 (63)
<i>r_s</i>	-.8	-.4	-.4	.6	.9	1.0	1.0	-1.0	.3	1.0	1.0	1.0	1.0	-1.0	1.0	1.0		
Food																		
Best Last	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1 (13)	2 (25)
Best First	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	0	7 (88)	5 (63)
<i>r_s</i>	.1	.8	-.6	.1	1.0	-1.0	1.0	-1.0	.9	1.0	1.0	1.0	1.0	1.0	1.0	-.7		
Exercise																		
Best Last	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0 (0)	1 (13)
Best First	0	0	0	1	1	1	0	0	1	1	1	0	0	1	1	1	4 (50)	5 (63)
<i>r_s</i>	.3	.6	1.0	1.0	1.0	1.0	-.3	-1.0	.7	1.0	.9	.8	.0	1.0	1.0	1.0		
Mixed																		
Best Last	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2 (25)	2 (25)
Best First	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	1 (13)	3 (38)
<i>r_s</i>	-.7	-.3	.3	.1	-.1	1.0	-.6	-.9	.1	1.0	.5	-.1	.4	-1.0	.4	.9		

Note. N = 8. HO = Hypothetical Outcomes; RO = Real Outcomes; *f* = frequency of participants; Best Last = whether the participant saved the best for last; Best First = whether the participant scheduled the best option first in the sequence; *r_s* = Spearman rank-order correlation between preference rank and position in the sequence.

Table 2

Saving the Best for Last, Scheduling the Best First and General Sequence Preference by

Category for Study 2 (Preschoolers)

	Participant				Summary		
	Cole	Andrea	David	Carla	<i>f</i>	(%)	<i>M</i> (SD)
Academics							
Best Last	1	0	0	1	2	(50)	
Best First	0	1	1	0	2	(50)	
<i>r_s</i>	-.30	.10	.40	-.60			-.10 (.44)
Story Time							
Best Last	0	0	0	1	1	(25)	
Best First	1	0	1	0	2	(50)	
<i>r_s</i>	.43	-.45	.10	-.60			-.13 (.48)
Food							
Best Last	0	0	0	1	1	(25)	
Best First	1	0	0	0	1	(25)	
<i>r_s</i>	.70	-.10	.40	-.90			.03 (.70)
Exercise							
Best Last	0	0	0	1	1	(25)	
Best First	1	0	1	0	2	(50)	
<i>r_s</i>	.30	.80	.70	-.89			.23 (.78)
Mixed							
Best Last	0	0	0	1	1	(25)	
Best First	1	0	1	0	2	(50)	
<i>r_s</i>	.70	.80	.50	.00			.50 (.36)
Leisure							
Best Last	0	0	0	0	0	(0)	
Best First	1	0	1	0	2	(50)	
<i>r_s</i>	1.00	.50	.67	.70			.72 (.21)

Note. *N* = 4. *f* = frequency of participants; Best Last = whether the participant saved the best for last; Best First = whether the participant scheduled the best option first in the sequence; *r_s* = Spearman rank-order correlation between preference rank and position in the sequence.

Figure 1

Correspondence between hypothetical survey and real outcomes.

