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Effects of Array Size on Preschoolers' Preference and Engagement: A Behavioral Translation of Choice Overload

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Recent social psychology and consumer behavior research has suggested that an abundance of options in choice contexts can have detrimental effects on decision making—a phenomenon termed *choice overload*. This investigation sought to use behavior analytic procedures to examine the effects of numerous options on the toy preference of 3 preschoolers. Toy engagement was assessed under repeated free-operant arrangements in which participants accessed arrays of either 6 or 30 toys for 2 min. Results showed that relative to the 6-item array, preference for the most preferred item was diminished and preference for the 3 least preferred items were elevated with the 30-item array. Additionally, engagement with toys in the 30-item array tended to occur more frequently but for shorter durations, suggesting an overall decrease in the reinforcing value of each toy when presented in a larger array. A behavioral interpretation of choice overload is offered, as well as potential implications for research and practice.

Keywords: choice, preference, engagement, choice overload, preschool children

Experimental studies on choice suggest a preference for the ability to choose over no choice opportunities (see Iyengar, 2010); such findings have been replicated across numerous species, including pigeons (e.g., Catania, 1975), primates (e.g., Suzuki, 1999), rats (e.g., Voss & Homzie, 1970) and humans (e.g., Tiger, Hanley, & Hernandez, 2006). In a series of seminal studies on the preference for choice, Catania demonstrated that pigeons allocated more responding to the initial links of concurrent-chains schedules of reinforcement associated with options in the terminal link (1975, 1980; Catania & Sagvolden, 1980). Notably, such preferences emerged after relatively few trials, despite equal reinforcement rates in no-option terminal links. These patterns of responding have led behavior analysts to conclude that preference for choice is not only ubiquitous but likely phylogenetic (Catania, 1975).

In addition to demonstrating preference for the ability to choose, laboratory research has shown that providing access to choice can increase the efficacy of reinforcement (Brigham & Sherman, 1973; Tiger et al., 2006; Tiger, Toussaint, & Roath, 2010). For example, in an early human operant demonstration with kindergarten students, Brigham and Sherman (1973) exposed participants to a multiple schedule consisting of participant-selected rewards, experimenter-selected rewards, experimenter-delivered praise, and no reward components. Their results indicated that participants engaged in relatively more responses within the component associated with participant-selected rewards as compared to the others.

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Given the existing body of literature on the value of choice, it is unsurprising that behavior analysts have used choice as both an antecedent- and a consequence-based intervention in clinical applications (e.g., Bannerman, Sheldon, Sherman, & Harchik, 1990; Dunlap et al., 1994; Heilman & Toffler, 1976; Kern, Mantegna, Vorndran, Bailin, & Hilt, 2001; Parsons, Reid, Reynolds, & Bumgarner, 1990; Vaughn & Horner, 1997). For example, Kern et al. (2001) provided three individuals who exhibited problem behavior the opportunity to choose their preferred sequence of tasks. The researchers found relatively higher levels of task engagement for all three participants when they were provided the opportunity to choose the sequence of tasks to complete as compared to when the experimenter chose the sequence. Vaughn and Horner (1997) found a similar result for half of their participants when examining task completion, in that participants completed more tasks when allowed to choose the tasks versus when tasks were chosen by the experimenter. These clinical investigations typically indicate beneficial effects from incorporating the opportunity to choose.

Because of its potential to enhance treatment outcomes, additional research has sought to evaluate conditions influencing the value of choice. For example, Tiger et al. (2006) demonstrated that preschool children preferred conditions in which they chose from among five identical edible items relative to conditions in which either no choice was provided or no reinforcer was available. Tiger and colleagues' subsequent demonstrations yielded findings suggesting preference for choice could be enhanced and established by increasing the number of identical choice alternatives. Further studies have since provided supporting evidence that increasing the variety of items in the choice array can increase the value of choice (Ackerlund Brandt, Dozier, Juanico, Laudont, & Mick, 2015; Sran & Borrero, 2010).

The use of choice in clinical service delivery exemplifies its potential to engender positive effects. However, researchers outside of behavior analysis have suggested that there are limits to the conditions under which choice is preferable and even that too much choice could have detrimental outcomes (e.g., Schwartz, 2004a, 2004b). In particular, a growing body of literature on the notion of *choice overload* suggests that abundant choice may have collateral undesirable experiential and behavioral consequences (Chernev, Böckenholt, & Goodman, 2015).

In one of the first empirical demonstrations of the "paradox of choice" (choice overload), Iyengar and Lepper (2000) presented differing choice scenarios to college students with a self-reported preference for chocolate. One group received a limited choice of six differently flavored chocolate candies presented in one row. A second group received an extensive choice composed of 30 chocolate candies presented in five rows of six. Participants in these two groups chose one chocolate from the array for consumption. A third group (control) received a randomly selected chocolate from the experimenter. Results indicated that, in comparison to those in the limited choice group, participants in the extensive choice group (a) took longer to choose a chocolate, (b) reported that 30 chocolates was "too many" to choose from, (c) reported that the decision making experience was "frustrating," and (d) felt less satisfied and more regretful about their choice after consuming their chocolate. However, participants in both "choice" groups reported higher satisfaction than participants in the "no-choice" group. These data suggest that choosing from larger arrays may have negative side effects both when choosing and when experiencing the outcome of a decision.

Research on choice overload typically has been conducted in the context of consumer behavior (e.g., making purchases) and often involves a single decision made by an individual exposed to one choice context in which multiple options are presented simultaneously. Using this preparation, numerous studies of choice overload have examined a variety of commodities—such as jam (e.g., Chernev, 2003), coffee (Mogilner, Rudnick, & Iyengar, 2008), electronics (e.g., Diehl & Poynor, 2010; Sela, Berger, & Liu, 2009), and retirement plans (Sethi-Iyengar, Huberman, & Jiang, 2004)—and obtained similar findings to those of Iyengar and Lepper (2000) with respect to the effects of array size. A parametric analysis of array size by Shah and Wolford (2007) also supports the claim that more options are not always better. In that study, college students were asked to choose which pen they preferred when presented with an array ranging in size from 2 to 20. The students were then told the pens each cost about $2 but they could purchase one for

$1. The researchers recorded whether students bought a pen at each of the array sizes and found a curvilinear relation between array size and the proportion of students who bought a pen, with the lowest proportion occurring with the largest array sizes (14–20), higher proportions with the smaller array sizes (2–6), and the highest proportion with an array size of 10.

Collectively, the choice overload literature suggests that too many options can lead to adverse subjective effects such as less satisfaction with, less confidence in, and greater regret following a decision, and objective effects such as decreased probability of making a decision, increased probability of changing selections, and decreased preference for large arrays (Chernev et al., 2015). However, the choice overload effect has failed to obtain in a number of studies assessing decision making with large arrays (Scheibehenne, Greifeneder, & Todd, 2010). To clarify the conditions that influence whether large arrays produce negative outcomes, Chernev et al. (2015) recently conducted a meta-analysis examining potential moderators of the choice overload effect. They found four antecedent factors that appeared to influence outcomes, which included choice set complexity (e.g., absence of a dominant option, attractiveness of the options), decision task difficulty (e.g., time constraints, presentation format), preference uncertainty (e.g., lack of expertise with the options), and decision goal (e.g., buying vs. browsing). Overall, these factors were associated with increased negative outcomes when they resulted in a more effortful decision, particularly when such decisions resulted in the loss of access to other valuable options.

One independent variable with a large potential to affect the difficulty of a choice and the availability of valuable options is the variety within choice arrays (Chernev et al., 2015). Kahn and Wansink (2004) conducted a series of studies on how array variety, in terms of composition and structure, influenced the consumption of various edible and leisure items by elementary schoolchildren and adults. They described array variety as comprising two components: (a) the number of distinct option categories, and (b) the number of replicates within categories. In one of the studies, the authors manipulated the number of replicates within the array while keeping the number of categories constant. They presented children with either a small array of six options (e.g., six different colors of M&Ms) or a large array of 12 options composed of two replicates of the small array (e.g., twice the amount of the same six colors of M&Ms). Results indicated the children consumed more of the items when presented with the large array. These findings suggest that the number of replicates can serve to increase variety and thereby influence consumption.

Overall, the choice overload literature indicates that array size and variety have potential to influence choice behavior. However, limited research has examined the extent to which these variables affect choice behavior in contexts and with populations commonly encountered by behavior analysts working in applied settings. A choice behavior frequently used by behavior analysts is *engagement*. Stimulus engagement has been used to identify preferences (e.g., Roane, Vollmer, Ringdahl, & Marcus, 1998) and may be a target for intervention in its own right (e.g., Engstrom, Mudford, & Brand, 2015) or utilized in interventions to displace maladaptive behavior (e.g., Piazza, Fisher, Hagopian, Bowman, & Toole, 1996). With respect to identifying preferences, engagement-based assessments are potentially more sensitive than commonly used selection-based assessments (DeLeon, Iwata, Conners, & Wallace, 1999; Hagopian, Rush, Lewin, & Long, 2001). As such, engagement may be a useful measure for examining choice overload effects at the level of the individual. Furthermore, given the uses of choice as an intervention and engagement as a target in clinical settings, understanding how engagement is affected by variables implicated in choice overload research could provide useful information for behavior analysts.

To date, no studies have examined how large arrays influence engagement or preferences determined by engagement. Therefore, in this experiment we sought to evaluate the effect of array size on toy preferences and engagement. To accomplish this, we manipulated the number of replicates within the array while keeping the number of categories constant.

Method

Participants, Setting, and Materials

Three children of typical development who attended a university-based preschool partici-

pated in the study. Alan, Billy, and Carol were all 4 years of age at the start of participation. Sessions were conducted with individual participants in a session room (2.2 m × 2.0 m) at the preschool, equipped with a mirrored observation window and an audio/video recording device. All sessions were video recorded.

Sessions consisted of trials in which the experimenter presented one array of either 6 or 30 toys in a 55 L clear plastic bin, which the experimenter allowed the participant to access for 2 min. The 6-item array contained six moderately preferred toys. The 30-item array contained five identical sets of the same six toys found in the 6-item array (e.g., if the 6-item array contained a school bus, the 30-item array contained five school buses).

Response Measurement and Interobserver Agreement

During trials, observers recorded the duration of participant's *engagement* with each toy. Engagement onset was scored when the participant touched a toy with their hands or feet for 2 s or longer and continued to be scored as long as they were in physical contact with the toy or their head was oriented toward the toy (e.g., rolled a ball and continued looking at it).

All trials were scored from video recordings. A second observer independently scored 30% of trials. Interobserver agreement (IOA) for engagement was calculated per occurrence within a trial and averaged across the trial. For each occurrence, the duration of the smaller value was divided by the larger; these quotients were averaged within the trial and then multiplied by 100. If observers recorded different toys as occurring during the same period, it would be considered a disagreement and a "0" would be used for this occurrence when calculating the agreement for the trial. Mean IOA for engagement was 97%, 95%, and 96% for Alan, Billy, and Carol, respectively.

Procedure

We conducted a paired-stimulus preference assessment (Fisher et al., 1992) of 10 toys with each participant prior to beginning the experiment. During trials, selecting a toy resulted in access to that item for 30 s. Results from the assessment (see Figure 1) were used to identify moderately preferred toys for inclusion in the subsequent experiment. We opted to use moderately preferred toys because of previous research indicating that the absence of strong

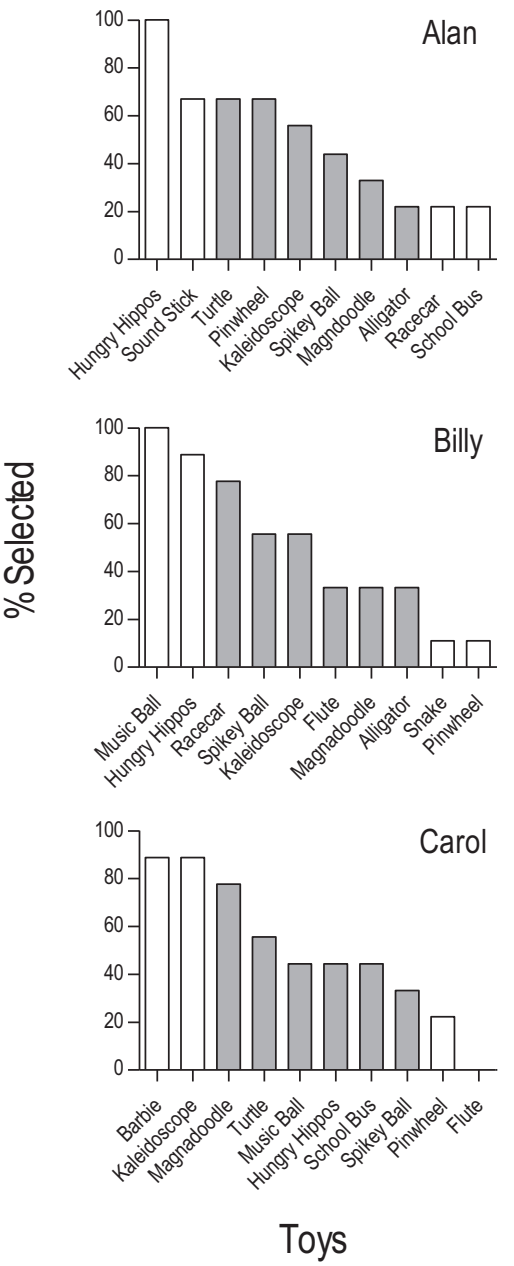

Figure 1. Percentage of item selections during the 10-item paired-stimulus preference assessment. Shaded bars denote items used in the experiment.

preferences is a necessary precondition for observing the choice overload effect (Chernev et al., 2015; Scheibehenne et al., 2010).

During the experiment, the researcher presented the participant with either the 6- or 30-item array for 2 min. Array sizes of 6 and 30 items were used on the basis of previous literature examining choice overload (e.g., Iyengar & Lepper, 2000). Trials of each array size condition were presented in a randomized order within each session to control for order effects. For two participants (Billy and Carol), sessions always consisted of two trials, and for one participant (Alan), sessions consisted of two or four trials. The experiment continued until a total of 10 trials of each condition were conducted.

At the beginning of each trial, the experimenter informed the participant that they could engage with only one toy at a time, emptied the contents of the bin onto the play mat on the ground, stated, "I'm going to do some work, you can play now," and started a timer set for 2 min. The experimenter did not initiate interaction during the remainder of the trial and provided minimal attention to participant-initiated interactions. In the event that participants engaged with more than one toy, the experimenter prompted them to engage with only one. If they did not comply, the experimenter physically prompted them to set down the second toy. At the end of the trial, the experimenter vocally prompted the participant to stop playing with toys and wait while the experimenter placed the toys back in the bin.

Results

Preference

The 6-item condition resembled typical free-operant preference assessments (Roane et al., 1998), with greater durations of engagement indicating higher preference. As such, we used preferences identified in this condition as the standard of comparison for the 30-item condition.

Figure 2 depicts the total duration of engagement with each item during the 6- and 30-item conditions for each participant. For all three participants, the duration of engagement with the most preferred item during the 6-item condition was higher than the duration of engagement with that same item in the 30-item condition. For two of the three participants (Alan and Carol), this item was also the most preferred in the 30-item condition, despite relatively lower engagement. For all three participants, total engagement with the three least preferred items in the 6-item condition was higher for those same items in the

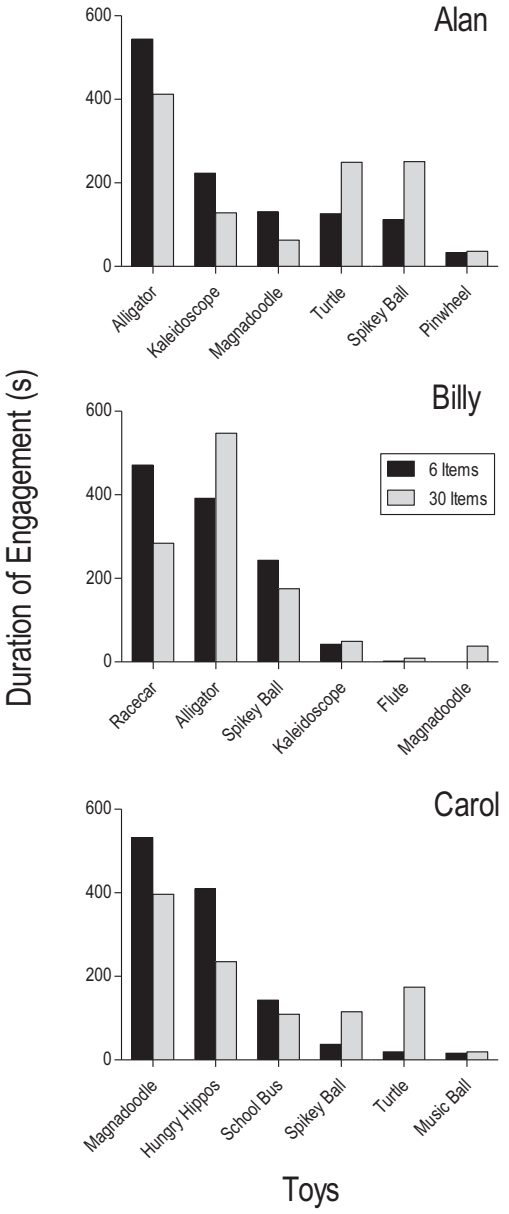

Figure 2. Total duration of engagement with each toy type during the 6-item (black bars) and 30-item (gray bars) conditions for each participant.

30-item condition. Specifically, engagement with the three least preferred items in the 6-item condition accounted for 23% (271 s), 4% (44 s), and 6% (72 s) of all engagement for Alan, Billy, and Carol, respectively; whereas, in the 30-item condition, those items accounted for 47% (536 s), 9% (96 s), and 29% (308 s) of all engagement for Alan, Billy, and Carol, respectively.

Engagement Episodes

The mean duration of engagement episodes was 45.0 s (SD = 36.2), 42.6 s (SD = 35.1), and 36.1 s (SD = 35.1) for the 6-item condition and 28.5 s (SD = 31.9), 29.8 s (SD = 31.5), and 13.3 s (SD = 18.4) for the 30-item condition for Alan, Billy, and Carol, respectively. Figure 3 depicts frequency distributions of engagement episode durations within 10-s bins across the 6- and 30-item conditions for each participant. For all three participants, brief durations of engagement episodes (those lasting between 2 and 10 s and 11–20 s) were markedly more frequent during the 30-item condition relative to the 6-item condition. For Billy, the frequency of engagement was equal to or higher during the 30-item condition up to the 31–40 s bin, and for Carol this pattern was observed up to the 51–60 s bin. Frequency of engagement episodes in the highest bins (81–90 s and above) did not differ substantially between conditions for Alan or Billy, but for Carol occurred more frequently in the 6-item condition.

Figure 4 depicts the total duration of engagement as a function of the frequency of engagement with each toy over the entire experiment for all participants. As evidenced in the figure, a stronger relation was observed between total duration and frequency of engagement with each toy for the 6-item condition as compared to the 30-item condition. That is, episodes of engagement were typically of a greater duration for toys in the 6-item condition relative to those same types of toys in the 30-item condition. Data for each participant are consistent with the general pattern observed when viewed collectively.

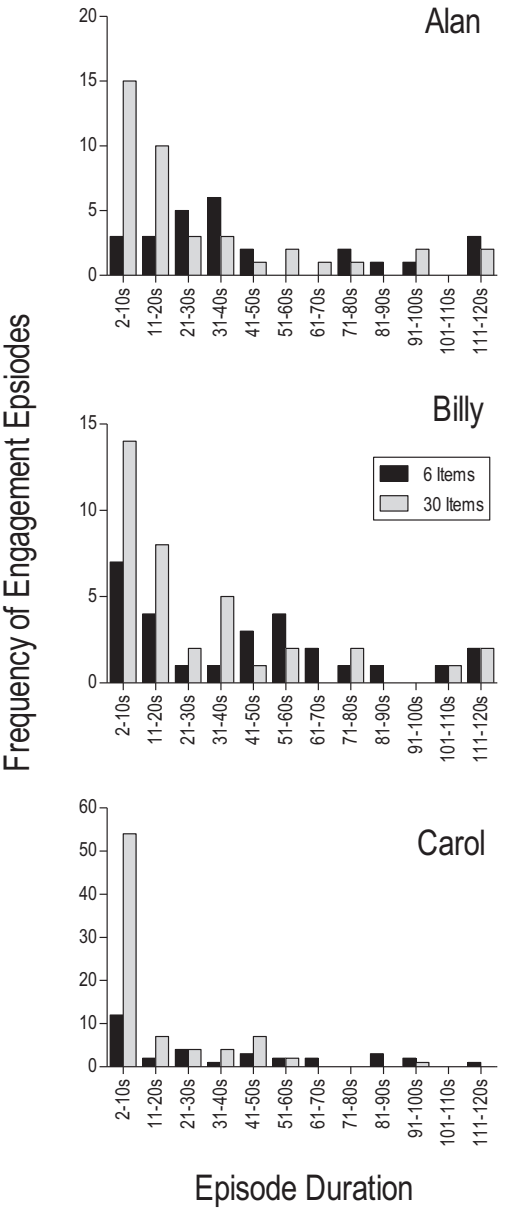

Figure 3. Frequency distributions of engagement episode durations within 10-s bins during the 6-item (black bars) and 30-item (gray bars) conditions. Note that the *y*-axis is scaled differently for each participant.

Discussion

This study sought to evaluate the effects of array size—a variable central to the choice overload phenomenon—on preschoolers' preferences for and engagement with toys. The evaluation used procedures typically employed in behavior analytic research (i.e., repeated, direct observation of free-operant behavior) as opposed to the single-decision scenarios often used in investigations of choice overload.

Results provide preliminary evidence that presenting items in larger arrays may influence

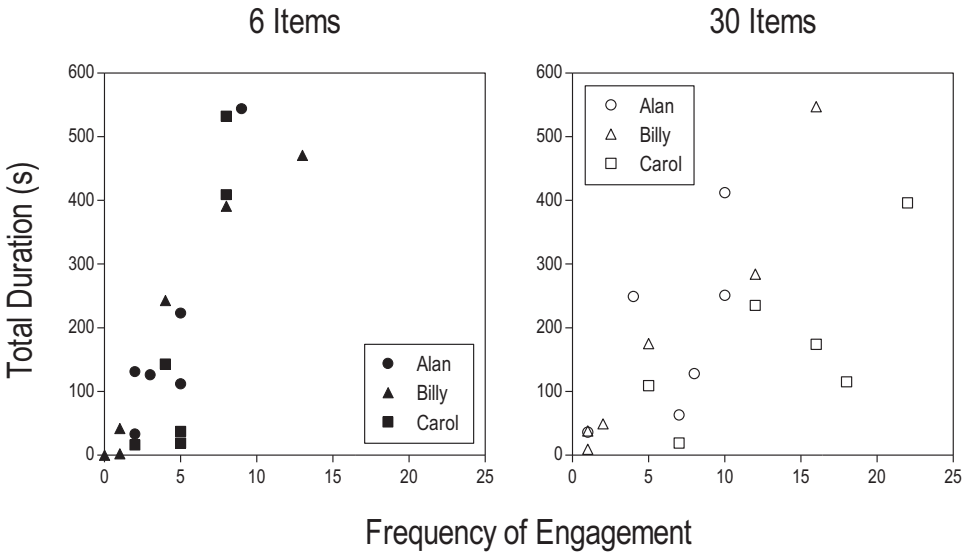

Figure 4. Scatterplots of total duration of engagement with each item for each participant as a function of frequency of engagement. Each point within a data path depicts one of the six toy types presented to the participants during the 6-item (left panel) and 30-item (right panel) conditions.

both preference for items and the manner in which engagement occurs. With respect to preference determined via item engagement, duration of engagement for the top preferred item in the 6-item condition was 25%–40% lower in the 30-item condition for all three participants. Additionally, engagement across the three least preferred items in the 6-item condition was higher in the 30-item condition for all participants. The absolute differences between conditions in engagement with these items varied across participants, but relative differences were such that total duration of engagement with these items in the 30-item condition was at least twice that of the 6-item condition.

With respect to overall patterns of engagement, we observed clear differences between the 6- and 30-item conditions. That is, for all participants engagement occurred more frequently and for shorter durations when presented with the larger array. Furthermore, when examining the relation between duration of engagement and frequency of engagement with each item, we again observed clear differences between the array sizes. The relation between duration and frequency of engagement was much stronger for the 6-item condition than the 30-item condition. Considering these data with respect to the matching law, which states that relative levels of behavior will match relative levels of reinforcement (Herrnstein, 1961), these results suggest the relative reinforcing value of engaging with any one item, while variable, was generally lower when presented within a larger array.

Taken together, these results appear compatible with findings reported in the choice overload literature in terms of both subjective and objective outcomes. That is, if the reinforcing value of options decreases and preferences become less pronounced when presented with large arrays, it seems likely that individuals would be apt to report decreased satisfaction/confidence with their selection, be less likely to make a single decision, and be more likely to change their selection.

We acknowledge that numerous differences in procedures between the present study and typical choice overload investigations preclude strong conclusions about the relation between our findings and those described in the choice overload literature. In particular, the use of repeated opportunities to choose within and across trials may be a critical difference, leading

to different behavioral processes. That is, in this experiment making a choice produced only a temporary loss of unselected options as the selection could be changed at any time, whereas in most studies of choice overload, making a choice results in the indefinite removal of the unselected options. This removal of unselected options seems likely to be a major component of the negative outcomes previously reported. Subjective reports of participants' satisfaction or negative experience with the arrays were not obtained and so a common measure from the choice overload literature (in terms of subjective experience) was not included, further limiting the comparison. Still, as a translational study, we consider our results as an encouraging step toward understanding the putative choice overload phenomenon based on behavioral theory and advocate for further research informed by this perspective.

A major limitation of this study was the descriptive nature of the research, as a within-subject design was not used to control for the effects of array size. Future investigations should seek to obtain additional data regarding the patterns observed in the present study in terms of the decreased engagement with highly preferred items, increased engagement with low preferred items, and more frequent episodes of short duration engagement. If similar results are obtained in future studies, examining aspects of the current preparation would be useful for determining the conditions needed to promote these effects. Potential manipulations could include increasing the length of the trials to more closely approximate clinical contexts, modifying the variety of the larger array (e.g., adding similar vs. identical items), or not limiting the arrays to moderately preferred items. Furthermore, given the restricted preferences seen in individuals with autism and other intellectual and developmental disabilities, future research should determine whether these patterns of responding would obtain with individuals with these diagnoses.

The present findings also raise questions with clinical implications that should be addressed in future studies. For example, the current results suggest that increasing the number of replicates available may be useful when trying to increase engagement with less preferred items, such as when a child has the opportunity to choose educational activities (e.g., Montessori education) or when perseverative preferences limit contact with other potentially valuable alternatives. Conversely, increasing replicates may be undesirable when looking to promote strong preferences or prolonged engagement with specific items. These considerations need to be borne out through empirical demonstration, and future research should investigate implications of choice overload in applied contexts.

In conclusion, both behavioral researchers and practitioners should consider that there may be unintended consequences due to features of the choice contexts, particularly in relation to item engagement and preference. This is not to say that choices should not be offered, but that more options may not always be beneficial to the individual making the choice. Additional behavior analytic research is clearly needed to further explore effects of the number and variety of options on choice behavior.

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