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More is more: toddlers do not show choice overload

Romulus J. Castelo*, Seokyung Kim and Stephanie M. Carlson

Institute of Child Development, University of Minnesota Twin Cities, St. Paul, MN, United States

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EDITED BY
Ramón García Perales,
University of Castilla-La Mancha, Spain

REVIEWED BY
Jessica Dollar,
University of North Carolina at Greensboro, United States
Ana Raquel Costa Aguiar,
Polytechnic Institute of Viana do Castelo, Portugal

*CORRESPONDENCE
Romulus J. Castelo
✉ caste151@umn.edu

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Psychological theory and research demonstrate the positive effects of personal choice on human motivation. However, there is evidence in adults that an overabundance of options can lead to choice overload, when choices become demotivating. Little is known about the early development of behaviors involving choice. Across two studies, we investigated whether toddlers (M age = 2.5 years) preferred choice over non-choice and tested for the presence of choice overload using a novel sticker-book task. Moreover, we explored associations between children's executive function (EF) skills and choice preference behavior. In Study 1 ($N = 106$), children preferred choice on 70% of trials, and this preference increased as a function of the number of options from 2-26. There was no evidence of choice overload. Study 2 ($N = 52$) replicated findings from Study 1 with up to 53 options, but there was no linear effect. Age (inversely) and sex (female) predicted choice preference in Study 2. Some aspects of parent-reported EF were inversely related to children's preference for choice, whereas a direct assessment of EF was positively correlated, independent of age. Future research should test for choice overload using alternative measures with a wider age range and clarify associations between EF and choice preference.

KEYWORDS

choice, choice overload, choice preference, executive function, early childhood

Introduction

Conventional wisdom suggests having more options is better. Decades of research have consistently demonstrated an effect of choice on various aspects of motivation, including perceived control, task performance, and intrinsic motivation (Patall et al., 2008). Much of this research is grounded in Self-Determination Theory, which posits that individuals have innate psychological needs for autonomy, competence, and relatedness. Providing people with choices is theorized to help fulfill the need for autonomy, leading to increased motivation and better life outcomes (Deci and Ryan, 2012). Further, researchers have contended that the desire to have and make choices allows individuals to exercise control over their environment (Leotti et al., 2010). Indeed, past research has shown offering choices to participants leads to an increase in liking and interest for a task (Cordova and Lepper, 1996; Iyengar and Lepper, 1999). In one seminal study, college students who were given the choice to work on three puzzles out of six available options demonstrated greater levels of engagement and spent more time working, compared to those given no choice about which puzzles to work on (Zuckerman et al., 1978).

Despite its documented benefits, choice may come with certain drawbacks (Schwartz, 2000). According to a theory on self-regulation, the act of making choices and exercising self-control is an effortful process drawing on a limited resource (Baumeister et al., 2018). Relatedly, larger assortments often demand greater time and effort from individuals, potentially triggering concerns about their ability to make optimal choices, resulting in regret (Iyengar et al., 2006; Schwartz, 2015). For example, in one study, although participants were initially more attracted to an extensive selection of jams, they were more likely to purchase a jar when they saw a limited selection (Iyengar and Lepper, 2000). In another study, Shah and Wolford (2007) showed a curvilinear relation between the number of options and subsequent purchasing behavior. College students were more likely to purchase a pen as the number of options increased, peaking at 10. As the number of options exceeded 10, however, the proportion of participants who bought pens declined. Moreover, adult participants reported lower satisfaction (Iyengar et al., 2006) and greater regret (Carmon et al., 2003; Sagi and Friedland, 2007; Inbar et al., 2011) with their choice when the set of available options was more extensive. These effects have been termed "choice overload" (Iyengar and Lepper, 2000; Diehl and Poynor, 2010).

We know little about this topic in children. Most developmental research concerning choice is in the context of intentionality and free will. Beginning at 9 months of age, infants can differentiate between an actor who is unwilling (has a choice) to give them a toy vs. an actor who is unable (has no choice) (Behne et al., 2005). By age 4, children in the U.S. have developed some intuitions about their own and others' freedom of choice, along with physical and mental constraints on that freedom (Kushnir et al., 2015). More direct research on choice preference has shown that preschoolers favor an array of options as opposed to one option (Tiger et al., 2006; Fenerty and Tiger, 2010). However, these latter studies had very small samples, including atypically developing children, limiting their analysis and generalizability. Recently, Carlson (2023) proposed a model linking children's sense of choice and agency to emerging executive function (EF), a set of neurocognitive skills required for goal-directed behavior including working memory, inhibitory control, and cognitive flexibility (Diamond, 2013). Early EF skills predict important developmental outcomes such as academic achievement (Willoughby et al., 2019) and physical and mental health (Moffitt et al., 2011). A large study found that parent provision of choice predicted child EF over and above age and other positive parenting behaviors, suggesting children's experiences with choice might be playing a key role in the early development of EF (Castelo et al., 2022).

Overall, developmental research has focused on outcomes related to choice including motivation, engagement, and learning. However, little is known about the act of making choices itself. Importantly, no studies to our knowledge have examined whether an overabundance of options leads to choice overload in toddlers. Early childhood might be an especially meaningful period to investigate as children start to develop a sense of agency over their actions through choice-making, increasingly demanding independence from their caregivers. Finally, although emerging theory suggests that choice is related to children's EF skills, we do not yet have empirical evidence to test these ideas.

We conducted two studies to address these gaps in the literature. In Study 1, we investigated toddlers' preference for choice and tested for choice overload using a novel behavioral task. We predicted children would prefer choice over non-choice, and that this behavior would follow an inverted U-shaped pattern, where preference for choice increases with the number of options up to a point, but then declines, indicating the presence of choice overload. Additionally, we predicted children with stronger EF skills would more strongly prefer choice over non-choice. In Study 2, we sought to replicate and extend these findings using a modified task where we increased the upper limit of options.

Study 1

Method

Participants

Families were recruited from a metropolitan area in the midwestern United States. Overall, 106 typically developing children (49% female) ages 21–41 months and their parents participated at home due to COVID-19 (Table 1). Children were primarily non-Hispanic White (88% White, 11% multi-racial/ethnic, 1% Asian). Families reported a median annual income of $125,000–$149,999. Parents were highly educated, with 41% completing at least a bachelor's degree and 55% completing a graduate or professional degree.

Procedure

Families received an email invitation to participate in a remote study. Participants were mailed study materials to their home address following consent. Parents were instructed to play a sticker book game with their child and were provided with detailed instructions. A subset of families (15%) completed the procedure live over Zoom with a researcher to verify they could follow instructions. These sessions were recorded and later reviewed by the lead author. Parents completed a 10-min survey via REDCap.

Measures

Choice preference and overload task

Parents were asked to complete this task with their child in a quiet area of their home. Children were told they were going to play a game where they get to choose animal stickers from a book. On each trial, children were presented with one sticker on the left page and an assortment of stickers on the right page while parents asked, *"Do you want to choose this one or do you want to choose one of these?"* The chosen sticker was removed and placed on a blank piece of paper. Each time the page was turned, the options on the right page increased by 3, from 1v2 to 1v26, for a total of 9 trials. These numbers were based on prior studies with adults (Iyengar and Lepper, 2000; Shah and Wolford, 2007). For half the participants, the Left/Right orientation was reversed along with the question order. Within each orientation, we introduced two conditions. For one group, the sticker on the singleton side appeared among the stickers on the multi-option side. For the other group, the singleton was unique. This was designed to compare behavior when there was No Cost (the same sticker could be obtained either way) to when there was a Cost (an option is removed). All stickers were identical in size and shape and were comparable in design and attractiveness. Each specific sticker was placed in each position across the full sample to guard against "favorite" stickers biasing the results. Following the completion of the task, parents were asked to photograph of each page and upload them for us to code children's selection on each trial (singleton or multi-option).

Family information questionnaire

The FIQ was used to collect demographic information from parents, such as child age, gender, race/ethnicity, family composition, parent education level, and family income.

TABLE 1 Study 1 descriptive statistics and bivariate correlations.

Variables	Range	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Age in months	21–41	30.22	4.79	—									
2. Gender	1–2	1.49	0.50	−0.03	—								
3. Proportion choice	0–1	0.70	0.31	0.08	−0.03	—							
4. Choice preference group	1–3	2.13	0.55	0.03	0.01	0.78**	—						
5. BRIEF-P inhibition	1–3	1.44	0.28	0.02	−0.10	−0.02	−0.04	—					
6. BRIEF-P shifting	1–3	1.36	0.35	−0.07	0.05	−0.05	−0.05	0.47**	—				
7. BRIEF-P emotional control	1–3	1.50	0.33	0.04	0.03	−0.01	−0.05	0.63**	0.44**	—			
8. BRIEF-P plan/organize	1–3	1.46	0.29	0.03	0.00	0.07	0.04	0.65**	0.34**	0.45**	—		
9. BRIEF-P working memory	1–3	1.39	0.31	−0.05	−0.03	0.07	0.09	0.72**	0.30**	0.44**	0.85**	—	
10. BRIEF-P total	1–3	1.43	0.25	−0.02	−0.03	0.02	0.00	0.89**	0.62**	0.72**	0.83**	0.87**	—

1. Age, Age in months. 2. Gender (1, Male; 2, Female). 3. Proportion Choice, Proportion of trials on which the child chose a sticker from the multi-option side. 4. Choice Preference Group (1, Selected the singleton on every trial; 2, Sampled both singletons and multi-options; 3, Selected the multi-option side on every trial). 5–10. Behavioral Rating Inventory of Executive Function–Preschool Version (BRIEF-P) raw scores (higher = worse EF). *p < 0.05 **p < 0.01.

Behavioral rating inventory of executive function–preschool version

The BRIEF-P is a 63-item parent-report measure of EF in children ages 2–5 years. For each item, parents were asked to report how often a behavior has been a problem for their child in the past 6 months (Never = 1, Sometimes = 2, Often = 3). Items were categorized across five subscales including Inhibition, Shifting, Emotional Control, Working Memory, and Plan/Organize. We used overall and subscale scores in our analyses.

Results

Overall, children showed preference for the multi-option side, selecting from that side on 70% of trials, $p < 0.001$, Cohen's $g = 0.20$ (medium effect) (Table 1). Nevertheless, we observed individual differences, with 9% of children selecting the singleton on every trial, 23% selecting from the multi-option side on every trial, and 68% sampling both sides. These overall choice preference patterns were unrelated to age and gender and were similar regardless of Left/Right orientation and Cost/No Cost conditions.

To test the choice overload hypothesis, following Shah and Wolford (2007), we conducted binary logistic regressions. The dependent variable was the child's selection (singleton vs. multi-option). Our primary independent variable was the number of options, which increased across 9 trials. For covariates, we first conducted individual binary logistic regression analyses with study variables and decided to include them as covariates in the full model only if they showed significance. Here, only Left/Right orientation predicted choice: The odds of selecting from the multi-option side were greater when it was presented on the right-hand page of the book ($OR = 0.64$ [0.48, 0.85], $p = 0.002$).

The results showed a significant association between the number of options provided and choice preference ($OR = 1.04$ [1.02, 1.06], $p < 0.001$) when covarying orientation. For each 3-item increase in the number of options, the odds of children choosing from that side increased by 1.04 (Figure 1). However, we did not find evidence for choice overload, as the quadratic term was non-significant ($OR = 1.00$ [1.00, 1.02], $p = 0.612$).

To test our secondary aim, we explored the associations between children's EF skills (parent-reported) and choice behavior. As shown in Table 1, none of the BRIEF-P subscales nor the total scores were associated with overall preference for choice. To examine this a different way, we conducted a series of binary logistic regressions, regressing choice (singleton vs. multi-side) onto BRIEF-P subscale and total scores. Children with weaker inhibitory control ($OR = 1.90$ [1.07, 3.37], $p = 0.028$) and working memory ($OR = 1.96$ [1.18, 3.25], $p = 0.009$) according to parents were more inclined to choose from the multi-option side, covarying orientation.

Study 2

Based on the findings from Study 1, we modified the Choice Preference and Overload Task to address several follow-up research questions. First, we adjusted task procedures to accommodate in-person testing. Second, we doubled the number of trials from 9 to 18 and, with that, increased the maximum number of options from 26 to 53 to test whether more options were needed to induce choice overload in toddlers. Third, we introduced a Descending condition in which the number of options on the multi-side decreased across trials. This was designed to compare choice behavior when the number of options increased vs. when they decreased, and the role of task experience. We predicted choice overload would be more likely to occur in the Ascending condition, once children had acquired several stickers already, whereas preference for choice would remain steadily high across trials in the Descending condition, as children would be drawn to the novelty and salience of the multi-side at the beginning and then continue to prefer it as resources appeared to be dwindling. Finally, we included direct-child EF assessments, given the study was conducted in-person.

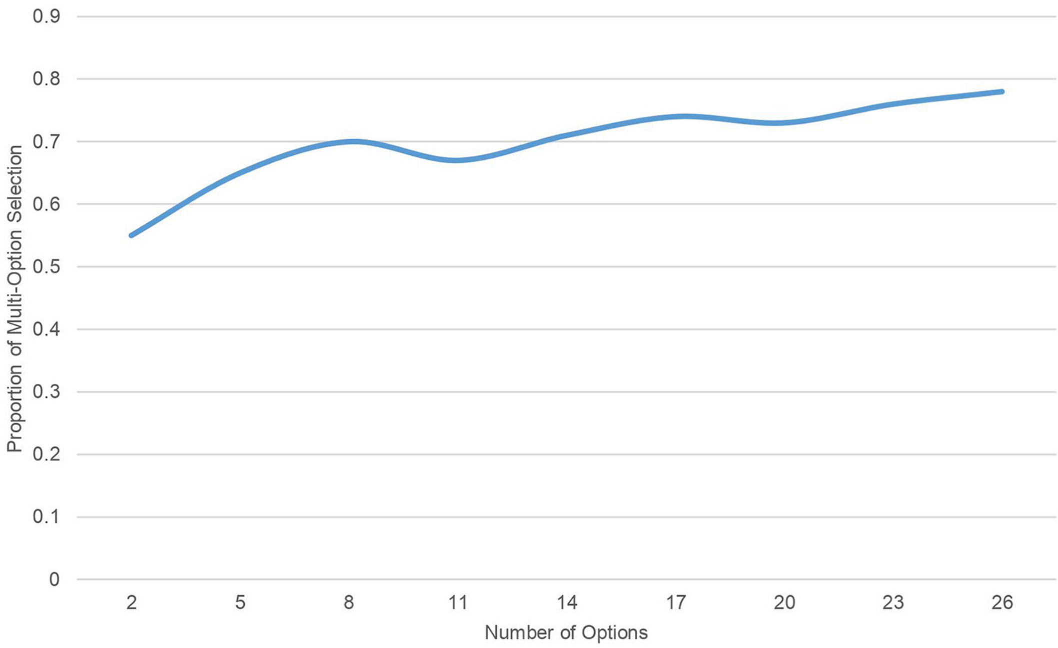

FIGURE 1
Choice preference by number of options in study 1.

Method

Participants

Families were recruited from the same metropolitan area as Study 1. Overall, 52 typically developing children ages 23–38 months (48% female) participated (Table 2). Most children were non-Hispanic White (62% White, 14% Asian, 23% White and Asian). Parents reported a median annual income of $125,000–$149,999. Parents were highly educated, with 56% having completed at least their bachelor's degree. Unfortunately, 44% of data regarding family income and parent education were missing due to the school-based location of the study.

Procedure

Children completed video-recorded sessions individually in a testing room. Parents were invited to complete a 10-min survey via Qualtrics.

Measures

Verbal ability

The verbal routing subtest of the Stanford-Binet Intelligence Scales was included as a potential control variable (Roid and Pomplun, 2012). In this task, children were asked to apply knowledge of concepts and language to identify and define increasingly difficult words like dog and apple. Raw scores were used in analyses.

Choice preference and overload task (adapted)

To accommodate the larger number of stickers, we used poster boards instead of sticker books. On each trial, children were presented with one sticker on the left side of the board and an assortment of stickers on the right side. The examiner asked, "*Do you want to choose this one or do you want to choose one of these?*", gesturing to the appropriate side. The selected sticker was removed and placed on a blank sheet of paper. With each trial, the options on the right side of the board increased by 3, from 1v2 to 1v53, for a total of 18 trials. For half the participants, the Left/Right orientation of singleton vs. multi-option was reversed, along with question order. Additionally, there were two conditions. For one group, the number of options on the multi-side increased in an ascending order across trials (2 to 53), whereas for the other, this was reversed in a descending order (53 to 2). Given there was no effect of Cost/No Cost in Study 1, this distinction was removed. As with Study 1, the stickers were designed to be comparable in size and attractiveness to reduce potential bias. Each specific sticker's location was randomized across participants. We coded this task based on the child's selection on each trial (singleton or multi-option).

Spin the pots

In Spin the Pots (Hughes and Ensor, 2005), children were asked to search for stickers in nine distinct boxes arranged on a Lazy Susan tray. Seven of the boxes were baited with a sticker whereas two remained empty. On each trial, children were invited to search one of the boxes for stickers. The boxes were covered with a scarf and spun around after each trial. The task ended when all seven stickers were found or when a maximum of 14 attempts had been made. Proportion scores were the number of stickers found divided by the total number of attempts.

TABLE 2 Study 2 descriptive statistics and bivariate correlations.

Variables	Range	*M*	*SD*	1	2	3	4	5	6	7	8
1. Age in months	23–38	31.08	4.32	—							
2. Gender	1–2	1.48	0.51	0.10	—						
3. Proportion choice	0–1	0.70	0.29	−0.25	0.14	—					
4. Choice preference group	1–3	2.00	0.40	−0.08	0.20	0.68**	—				
5. Stanford-binet verbal	0–72	13.00	3.39	0.44**	0.34*	0.12	0.08	—			
6. MEFS total	0–100	23.44	13.67	0.51**	0.25	0.00	0.03	0.28	—		
7. MEFS standard	60–140	104.63	5.76	0.17	0.26	0.23	0.25	0.23	0.85**	—	
8. Spin the pots	0–1	0.59	0.19	0.22	0.24	−0.01	0.02	0.44**	0.41**	0.44**	—

1. Age, Age in months. 2. Gender (1, Male; 2, Female). 3. Proportion Choice, Proportion of trials on which the child chose a sticker from the multi-option side. 4. Choice Preference Group (1, Selected the singleton on every trial; 2, Sampled both singletons and multi-options; 3, Selected the multi-option side on every trial). 5. Stanford-Binet Verbal Routing Subtest total raw score. 6. Minnesota Executive Function Scale total score. 7. Minnesota Executive Function Scale standard score. 8. Proportion of stickers found in Spin the Pots. *p < 0.05 **p < 0.01.

Minnesota executive function scale

The MEFS is a digital game-like measure administered on an iPad, requiring the use of working memory, inhibitory control, and cognitive flexibility (Carlson and Zelazo, 2014). Children were asked to sort cards according to a specific dimension (e.g., size and color) and then were asked to switch the sorting rule (e.g., big goes with big, and then big goes with little). Starting level was based on age and the game automatically moved up or down depending on performance. For analyses, we used total scores, which accounts for accuracy and response time, and standard scores adjusted for age and sex.

Results

Consistent with results from Study 1, children preferred a sticker from the multi-option side on 70% of trials, $p < 0.001$, Cohen's $g = 0.19$ (medium effect) (Table 2). There were again individual differences, with 8% of children selecting the singleton on every trial, 8% selecting from the multi-option side on every trial, and 84% sampling both sides. These overall choice preference patterns were unrelated to age and gender (Table 2) and were similar regardless of Left/Right orientation and Ascending/Descending conditions.

To examine the probability of selecting the multi-option side across trials, we again conducted binary logistic regression analyses. A similar approach to Study 1 was used to determine which covariates to include. Age and gender were significant predictors (age: $OR = 0.91$ [0.88, 0.94], $p < 0.001$; gender: $OR = 1.53$ [1.15, 2.04], $p = 0.004$), and thus were included as covariates in the full model. More specifically, younger children were more inclined to choose from the multi-option side compared to older children, and females tended to prefer the multi-option side compared to males. Given that sequence (Ascending/Descending) and Left/Right orientation were non-significant, all groups were combined in the following analyses.

The results did not show a significant association between the number of options and choice ($OR = 1.00$ [0.99, 1.01], $p = 0.73$) when covarying child age and gender (Figure 2). Child age and gender remained significant predictors (age: $OR = 0.91$ [0.87, 0.94], $p < 0.001$; gender: $OR = 1.60$ [1.20, 2.16], $p = 0.002$). Similar to Study 1, we did not find evidence for choice overload as the quadratic term was non-significant ($OR = 1.00$ [0.99, 1.00], $p = 0.263$).

We again examined associations between children's EF skills and choice behavior. Neither EF measure was correlated with overall preference for choice (Table 2). When we regressed choice on children's cognitive flexibility (measured by MEFS) covarying child age and gender, children with higher cognitive flexibility were more likely to choose from the multi-option side ($OR = 1.03$ [1.01, 1.04], $p = 0.001$). The association between working memory (measured by Spin the Pots) and choice behavior was non-significant ($OR = 0.93$ [0.40, 2.17], $p = 0.872$).

Discussion

There is an intriguing area of research exploring our tendency to gravitate toward opportunities for choice. However, an overabundance of options may lead to choice overload, referring to the difficulty with decision-making when presented with many options (Schwartz, 2015). Although prior research with children has suggested they are sensitive to choice, there were no systematic studies of choice preference or overload in children. The current studies investigated choice preference and choice overload in toddlers, who are just beginning to exert independence from caregivers, using a novel age-appropriate behavioral task. In two studies, we found that toddlers overall preferred choice over lack of choice at the same rate (7 times out of 10, on average). This finding is consistent with prior research showing preschoolers favored choice when selecting treats (Tiger et al., 2006; Fenerty and Tiger, 2010), yet we tested a larger sample of younger children and systematically varied the number of options. Children in our study clearly preferred choice over non-choice, even when the subsequent rewards were equivalent (i.e., 1 sticker on each trial, regardless of the number of options). This evidence supports prior claims that choice is inherently desirable and humans may indeed be "born to choose" (Leotti et al., 2010). Nevertheless, there were individual differences, with both studies revealing that a small percentage of children selected the *singleton* on every trial. Further research is needed to determine temperamental or environmental sources of this behavior. For example, children with heightened sensitivity to

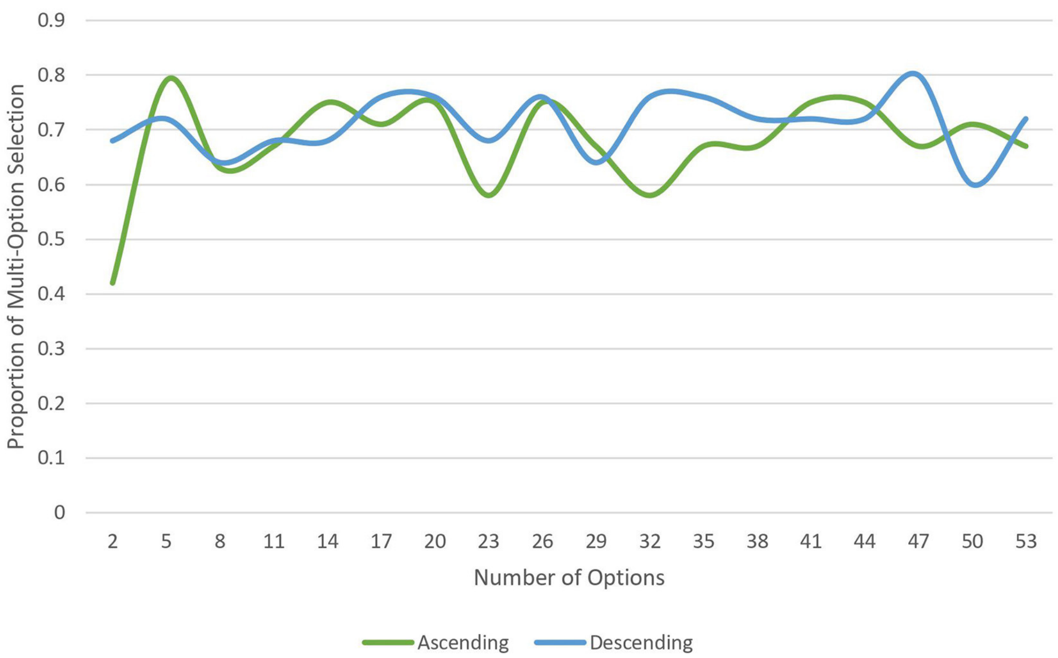

FIGURE 2
Choice preference by number of options in study 2.

rewards may naturally gravitate toward opportunities for choice. Moreover, in Study 2, the evidence suggested that children might begin to "outgrow" this tendency from 2 to 3 years of age. The reason we saw this only in Study 2 could be because there were many more options compared to Study 1. Finally, in Study 2, girls were more inclined to prefer choice than boys. This finding will need to be replicated, but it is consistent with research showing that women valued the act of choosing from alternatives (compensation plans) more than their male counterparts (Mattila, 2010).

We found no evidence of choice overload among toddlers, even with as many as 53 options. In fact, in Study 1, children were *more* likely to select from the multi-option array as the number of options increased, up to 26. We did not find a similar linear effect in Study 2, however. This could be explained by several factors, including variations in our task procedures between studies and a smaller sample size in Study 2 limiting statistical power, especially in the comparable Ascending condition (Ns = 106 vs. 26). In contrast, there is evidence of choice overload occurring at a peak of 10 options, using a similar paradigm with college students (Shah and Wolford, 2007). Thus, this construct may change over the course of development. For example, 9–11-year-old children exhibited fewer negative consequences when faced with an overabundance of choice in contrast to adolescents (Misuraca et al., 2016). Further, among adults, some are "maximizers" who tend to seek out more opportunities for choice with the goal of finding the best possible alternative, in contrast to "satisficers" who are looking for something that is "good enough" (Schwartz et al., 2002; Correia, 2013). It is possible there are also developmental changes wherein children tend to become less maximizing and more satisficing with age.

Regarding our exploratory question concerning EF, results were mainly non-significant or inconsistent. In Study 1, we found individual differences in two of the BRIEF-P subscales negatively predicted preference for choice. Specifically, children with weaker working memory and inhibitory control according to their parents tended to choose from the multi-option array. Indeed, it may require children to engage self-control to resist choosing from a larger array of attractive stickers. Interestingly, we found the opposite effect in Study 2, in which children with stronger EF according to a direct assessment (MEFS) were more likely to choose a sticker from the multi-option array. Although this effect was small, it is possible that children with better EF are more inclined to seek out opportunities for choice. The direction and strength of these associations may also be a function of the type of EF measure used (parent report vs. direct-child measure).

Limitations and future directions

Our studies had several limitations. First, we used only one measure of choice overload. More specifically, we adopted a similar conceptualization of choice overload from a study conducted with college students which found that buying behavior conformed to a curvilinear function of the number of options offered (Shah and Wolford, 2007). In our studies, we considered a significant quadratic effect to be indicative of choice overload. Prior research on choice overload with adults has used a range of other measures, including various internal states (e.g., choice satisfaction, regret, and confidence) and behavioral consequences (e.g., the likelihood of deferring or switching choice, and assortment choice; Chernev et al., 2015). Future research should consider including these measures to test for choice overload in children.

Second, although we considered Left/Right orientation, attractiveness of stickers, and whether a given sticker would be available from either side, we did not systematically account for the potential bias of visual salience. It is plausible that children selected from the multi-option array due to the quantity of options being more attention-grabbing, in addition to, or even instead of, the element of choice. We are addressing this limitation in a current study by presenting children with two different arrays to choose from, such as one containing 6 identical options and another containing 6 unique options. Even so, simple salience would not account for the finding that a subset of toddlers chose the singleton on *every* trial in both studies.

Third, in addition to more task paradigms, more research is needed to examine developmental and social influences on choice preference and overload. Within our limited age range, we found an inverse relation with age and greater preference for choice among females, but only in Study 2. A larger sample with a broader age range would help clarify these results. As well, our sample was limited to majority White, highly educated American families. Choice behavior is likely to be strongly influenced by social and cultural contexts (Savani et al., 2008; Schwarz, 2018), which is a topic for further research.

Finally, it is important for future research to clarify the associations between EF skills and choice behavior and explore potential social influences. For example, there is a compelling theoretical argument in which parent provision of choice is thought to be a key ingredient in facilitating children's sense of agency and control, which in turn allows them to engage their EF skills in service of goal-directed behaviors (Carlson, 2023). These associations are likely bidirectional, but more data is needed to validate these ideas. Testing children's preference for choosing for oneself vs. having someone else choose for them (i.e., exercising autonomy) might be better aligned with Carlson's (2023) proposal than our paradigm, which was intended to investigate choice overload.

Conclusion

Across two studies, we demonstrated that toddlers prefer choice over lack of choice using a novel behavioral task. In contrast to prior research with adults, we did not find evidence for choice overload, suggesting that toddlers' affinity toward choice remained despite an overabundance of options. Importantly, individual differences in EF skills appear to be linked to choice preference. However, future research should clarify the direction and strength of these associations using additional developmentally appropriate tasks to measure choice behavior and EF skills. This is a promising area of research to advance our understanding about the development of children's personal agency and autonomy through choice-making and how it relates to emerging cognitive skills.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Institutional Review Board at the University of Minnesota Twin Cities. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

RC: Conceptualization, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing. SK: Formal analysis, Writing – original draft, Writing – review & editing. SC: Conceptualization, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

SC is a co-founder and holds equity in Reflection Sciences, Inc., which has licensed the Minnesota Executive Function Scale (MEFS) from the University of Minnesota. These interests have been reviewed and managed by the University of Minnesota in accordance with its Conflict of Interest policies.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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