Why young children think actions aren't swayed by sunk costs: Testing two accounts

Abstract

Adults think that sunk costs are relevant to predicting choices, but young children do not. In this paper, we tested between two accounts for why children do not make sunk cost predictions. One account holds that children conceive of sunk costs in a fundamentally different way than adults. The other account denies this but holds that children do not reason about sunk costs spontaneously. We tested between these accounts in three experiments on 4-7-year-olds (*N*=484). Children saw sunk cost scenarios where an agent collected objects that were easy or difficult to obtain but could only keep one. Before predicting the agent's choice, children were prompted to think about some aspect of the situation theorized to underlie sunk cost predictions in adults (effort, waste, emotion) or instead were asked a control question. The findings supported both accounts. In line with the spontaneity account, children aged 6 and older made sunk cost predictions when prompted to think about effort (all experiments), the agent's emotions (Experiment 1), and one form of waste (Experiment 3). However, in line with the account positing discontinuity between children and adults, prompting did not bring younger children to make sunk cost predictions, and even among older children, predictions were not at ceiling. This suggests that sunk costs are not fundamental to conceptions of choice. The developmental shift we observed likely reflects broadening in the factors that children see as relevant for choices around objects. We discuss potential drivers of this shift, including firsthand experience with costs and enculturation.

Keywords: sunk cost bias; action prediction; effort; waste; cognitive development

Public Significance Statement

Adults think that sinking or investing costs (i.e., time, effort, or other resources) in goals matters for future choices. For instance, they think sunk costs invested in a goal increase willingness to further invest in it, or to capitalize on it. Younger children, though, do not think sunk costs matter for choices. We tested two opposing accounts of why children neglect sunk costs to better understand the nature of sunk cost thinking. To our surprise, the findings provided support for both accounts. Older children's responses supported an account holding they see sunk costs much as adults do, but do not think about them spontaneously. By contrast, younger children appeared to see sunk costs in a fundamentally different way than adults. Overall, these results suggest that respect for sunk costs is not a fundamental aspect of people's understanding of choice and may instead be learned through direct experience or enculturation.

Why young children think actions aren't swayed by sunk costs: Testing two accounts

Young children do not expect that choices will be swayed by sunk costs—costs incurred pursuing an object or goal. Consider a story where a girl first collects one flower from a tall hill that is difficult to climb and another identical flower from a short hill that is easy to climb, but then learns she can only keep one flower. When asked which flower the girl will keep, adults attend to sunk costs and mostly choose the flower that took more effort to obtain. By contrast, children aged 4-7 are unaffected by sunk costs and choose between the flowers at random (Sehl et al., 2021, 2024). Or consider the decision of how long to persist in working on a difficult but boring jigsaw puzzle. Adults predict that they will complete more of the puzzle if they imagine having bought it rather than having received it for free. But young children's predictions are again unaffected by sunk costs (Hamzagic et al., 2025). Other studies also generally find that young children do not predict that actions will be biased by sunk costs (Baron, et al., 1993; Webley & Plaisier, 1998; for work on older children see Klaczynski, 2001; Klaczynski & Cottrell, 2004; Morsanyi & Handley, 2008).[1]

Understanding why young children do not consider sunk costs would be informative about the nature of sunk cost predictions and about developmental changes in people's conceptions of costs and choice (for recent treatments see Jara-Ettinger et al., 2016; Finiasz et al., 2025; Zhao & Kushnir, 2023). On one hand, there is no rational reason why people should honor sunk cost when deciding how to act. Once costs have been sunk, they cannot be recouped (e.g., Arkes & Blumer, 1985; Baron, 1985; Thaler, 1980). Even so, anticipating that sunk costs

[1] Some findings could be viewed as suggesting that children do show the sunk cost bias. For instance, Baron et al. (1993) found that roughly half of 5- to 11-year-olds gave responses consistent with sunk-cost reasoning, with many referencing prior investment in their justifications. While this could show that some children do consider sunk costs, it is hard to be certain, since just as many children were not biased by sunk costs and at least some of the justifications offered as supportive are open to other interpretations.

sway people's actions may be functional, insofar as people's real-world decisions are affected by sunk costs.[2] Children's indifference to sunk costs could suggest that the pull of honoring sunk costs is not fundamental to action prediction and might instead reflect learning or enculturation. Alternatively, if young children do make sunk cost predictions under some circumstances, this would suggest continuity in conceptions of relations between costs and actions across the lifespan.

Two Accounts

We test between two accounts for why young children do not make sunk cost predictions. On one account, this is because young children see sunk costs in a fundamentally different way than adults. For instance, children could differ from adults in their conceptions of waste, which is central to explanations of the sunk cost bias (Arkes, 1996; Arkes & Blumer, 1985; Larrick et al., 1990). In the flowers scenario, adults might think that giving up a flower wastes the effort invested in obtaining it and that keeping the high-cost flower minimizes this waste. Young children, however, might not see effort as something that can be wasted. Children do recognize the wastefulness of throwing away physical resources (Choshen-Hillel et al., 2020; Sehl et al., 2023; Sorokowska et al., 2020). But this understanding develops relatively late, around age six, and says nothing about wasted effort.[3] Other explanations focusing on children's conceptions of waste are also possible. For example, young children might see effort as wasted but might not see how an agent's choice could minimize or avoid this waste.[4]

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[2] Evidence that people adults honor sunk costs in their real-world choices is mixed (e.g., Cunha & Caldieraro, 2009; Friedman et al., 2007; Negrini et al., 2022) but overall does suggest that people are biased by sunk costs (see Roth et al., 2015 for a meta-analysis).

[3] An understanding of wasted effort might seem to be implied by expectations in infants and young children that agents will minimize effort in pursuing goals (e.g., Bennett-Pierre et al., 2018; Gergely et al., 1995; Gönul & Paulus, 2021; Liu & Spelke, 2017; Mascaro & Csibra, 2022; Paulus & Sodian, 2015). But rather than involving considerations of wasted effort, these expectations could instead reflect preferences for achieving goals quickly.

[4] It would be rational for children to find this perplexing given that sunk costs cannot be recouped (e.g., Thaler, 1980). That is, while keeping the high-cost item might *seem* to minimize waste, it does not.

The other account we consider posits that children conceive of sunk costs in much the same ways as adults, but do not do this *spontaneously*. Whereas adults might naturally think about the prospect of wasted effort in sunk cost scenarios, children might only consider wasted effort if explicitly asked about it. This account aligns with other instances where children can make certain inferences and predictions, but do not make them spontaneously (e.g., Doan et al., 2018; Edwards et al., 2019; Engle & Walker, 2021; Legare & Lombrozo, 2014; Nyhout et al., 2019; Williams & Lombrozo, 2010). For instance, when asked to infer which objects have the same insides (or the same name), 3-5-year-olds typically overlook objects' causal properties and instead base responses on perceptual similarity. While this could suggest that young children only reason about perceptual properties, prompting children to explain the outcome of a causal intervention leads them to base these judgments on causal properties (Walker et al., 2014).

Prompting children may similarly lead them to reason about sunk costs. Asking children to think about effort or waste could bring them to think about how efforts could be wasted. Children might also make sunk cost predictions if asked about emotions. In adults, sunk cost predictions could rest on the expectation that abandoning costly goals is disappointing. For instance, predictions that the girl in the flower scenario will keep the high-cost flower could stem from the belief that she would be sadder to lose it than the low-cost one (Arkes, 1996; Dijkstra & Hong, 2019; see also Wong & Kwong, 2007; Zeelenberg & Van Dijk, 1997). Prior work shows that from around age 5, children expect others will be sadder about leaving behind objects that were more costly to obtain (Sehl et al., 2024). But these attributions of emotion might not be spontaneous and may only arise if prompted.

We tested between the two accounts in three experiments. In each experiment, children saw sunk cost vignettes where an agent obtained desired items. Next children were asked a

prompt question, either about a potentially relevant aspect of the scenario (effort, waste, or emotion) or a control prompt. After the prompt, children were asked to predict how the agent would act. If children's conceptions of sunk costs differ from those of adults, their responses should not be affected by the prompt questions. For example, they should be no more likely to make sunk cost predictions if asked a prompt question about effort than if asked a control prompt. By contrast, the spontaneity account predicts that prompting children to think about relevant aspects of the scenario could trigger sunk cost predictions.

In each vignette, the agent wanted and collected two identical looking items: a high-cost item that was difficult to obtain and a low-cost item that was easy to obtain. The agent then learned that they could only keep one item, and children predicted which the agent would keep. This scenario was closely based on Arkes & Blumer's (1985) classic TV dinner task, where participants imagined buying one TV dinner for $5 and another identical one for $3 and then judged which they would choose if they could eat only one, and had to throw the other away (also see Harrison & Shanteau, 1993 and Sirois, 2019). One potential concern with these scenarios is that participants could infer that the high-cost item was preferred from the start, even before costs had been incurred. But the scenarios do not provide evidence for this. Seeing that the agent incurred greater costs for one item does not imply it was preferred, since the agent might have been willing to incur the same cost (or even a greater one) for the low-cost item. Other aspects of these scenarios may also discourage inferences that the high-cost item was preferred from the start, namely the items looking the same and the agent initially hoping to obtain both of them.

In our first experiment, we tested children aged 5-7. One motivation for exploring this age range was to determine *when* prompts might first affect sunk cost predictions, and to discern

if some prompts were effective earlier than others. In this experiment, children were assigned to one of three conditions with different prompt questions: effort, sadness, control. In the second experiment, we again tested children aged 5-7, but this time used effort, waste, and control prompts. Finally, in the third experiment, we restricted testing to children aged 6-7 and again used effort, waste, and control prompts, though we asked about a different aspect of waste than before.

General Method

Transparency and Openness. Materials, data, and analysis code are available online at https://osf.io/5fwa7/overview. We report all measures, experimental manipulations, and exclusions. These studies were approved by the Office of Research Ethics at the University of Waterloo. The studies were not preregistered.

Most children were tested in person at childcare centers and schools in the Waterloo Region (91% in Experiment 1, 95% in Experiment 2, 79% in Experiment 3). The remaining children were tested online via Zoom in the presence of their parent or guardian who was instructed to look down or to turn away from the screen while testing took place. Demographic information was not collected from each child as per the allowances of our IRB application. However, a recent census showed that 64% of residents in the region are White, and South Asians are the largest visible minority; these figures were corroborated by a census of students in the Waterloo Regional school board where most children were tested.

In each experiment, children saw two sunk cost scenarios in a fixed order (boy with rocks first, girl with flowers second) with the location of the high-cost object counterbalanced across scenarios (right side in first scenario, left side in second). At the end of each scenario, children were first asked a prompt question, and were then asked the test question about which items the

agent would keep. The main analysis in each experiment examines responses from children regardless of how they responded to the prompt. However, we also report the results when the data are limited to children who gave the target response to the prompt on their first attempt. The Supplemental Materials include plots showing children's predictions of which item the agent would keep at each age in years, split by how children answered the preceding prompt questions.

We separately analyzed children's responses using generalized estimating equation (GEE) models with condition and age in months entered as predictors; the models used an exchangeable correlation matrix. The models were run in R using the geepack package (Højsgaard et al., 2006) with the output passed to the joint_tests function from the emmeans package to produce an omnibus test (Lenth et al., 2019). We also used the emmeans package to conduct Bonferroni corrected pairwise comparisons. We conducted single-sample comparisons against chance in two ways. When responses were not affected by age, we ran intercept-only GEE models. When responses were affected by age, we examined the age at which 95% confidence intervals, predicted using the ggeffects package (Lüdecke, 2018), first did not include chance (i.e., 0.5) in their range.

Experiment 1

Methods

Participants. We tested 180 children aged 5-7 (M_{age} = 6;5 [years;months], range = 5;0-7;11, 84 girls, 94 boys, 1 undisclosed; 60 children per age in years). We chose sample sizes in all experiments based on previous work that used similar designs (e.g., Sehl et al., 2024); no formal a priori power analyses were conducted.

Procedure. Children saw two scenarios in which an agent collected one item that was easy to obtain and another identical-looking item that was difficult to obtain, and then afterwards

found out they could not keep both; see Figure 1. In the first scenario, a boy collected one rock from a shallow sandpit and another rock from a deep one. In the second scenario, a girl collected one flower from a short hill and another flower from a tall hill.

After each scenario, children were asked a prompt question, which differed across three between-subjects conditions. In one condition, the question was about the effort the agent invested in obtaining the items. Considering effort might bring children to think about wasted effort, which has been posited to underlie sunk cost predictions. In another condition, the prompt question was about which item the agent would be saddest to lose. We asked this question since sunk cost predictions could also depend on recognizing that abandoning costly goals is disappointing. In the remaining condition, the prompt was a control question, which served as a baseline. Here are the wordings of these prompt questions from the scenario with the flowers:

Effort. The girl worked hard to get both flowers. Which flower was harder for her to get?

Sad. The girl is sad she can't keep both flowers. Which flower is she more sad about?

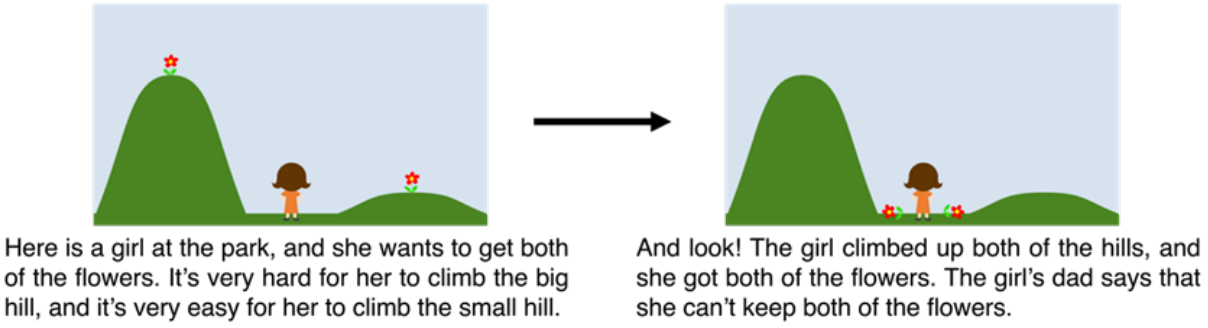
Control. The girl climbed both hills to get the flowers. Which flower is from the bigger hill?

Importantly, we expected that most children would answer all three prompts by choosing the high-cost item. It was the correct answer in the Effort and Control conditions, and it was expected based on recent findings in the Sad condition (Sehl et al., 2024). If children instead chose the low-cost item or did not choose either item, the scenario was repeated from the beginning and the prompt was asked again. If they did not choose the high-cost item on their second try, the experimenter told them it was the answer and moved on. For instance, in the Effort condition, the experimenter pointed to the flower from the taller hill and said, "Well, the girl actually worked harder to get this flower". In the Sad condition, the experimenter said,

"Well, the girl actually feels more sad about this flower". Children across all conditions were then asked the main test question. Here is the wording from the flower scenario: "The girl's dad says that she can keep one of the flowers. Which flower will she keep?".

Figure 1

Slides and Script from the Flower Scenario in All Experiments



Note. Children were shown the pictures and scenario and answered two questions. The first was a prompt question, corresponding to their assigned between-subjects condition. The second was a test question, asked of all children: "Which flower will the girl keep?"

Results

When each prompt was initially asked, most children chose the high-cost item as expected: 97% for effort, 75% for sad, and 96% for the control. Once children who did not give this response were re-asked the prompts, the proportion was 100% for effort, 91% for sad, and 98% for the control.

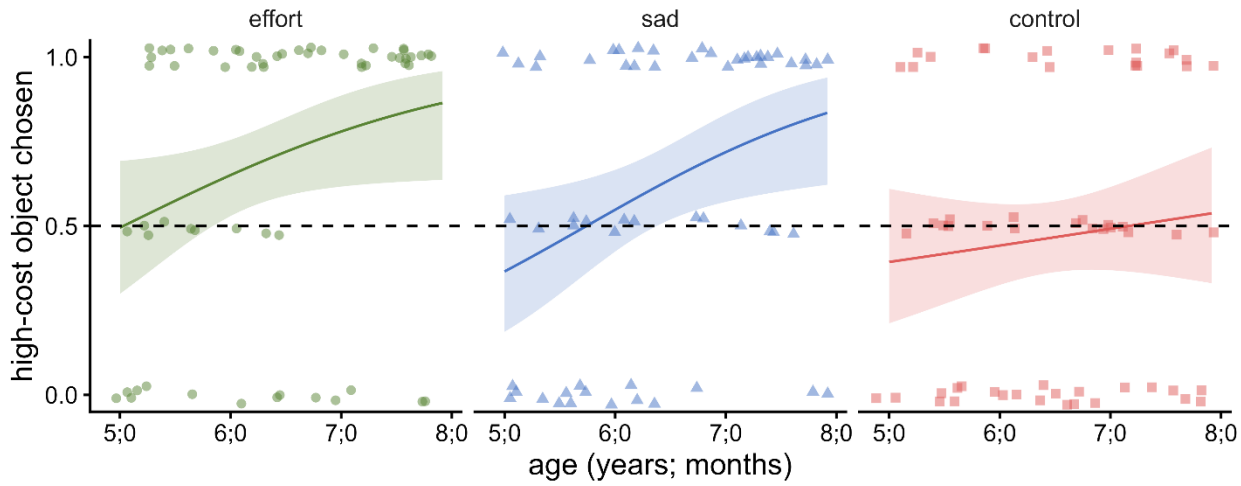
To determine if sunk cost predictions varied across the three conditions, we entered choices of the high-cost (scored 1) and low-cost (scored 0) items into a condition by age GEE model; see Figure 2. There was a main effect of condition, $F(2, 352) = 4.69$, $p = .010$, a main

effect of age, $F(1, 352) = 9.22$, $p = .003$, and no interaction, $F(2, 352) = 1.04$, $p = .353$. Children chose the high-cost object more often in the effort than control condition, $p_{Tukey(3)} = .010$. Choices in the sad condition did not differ significantly from those in either the effort condition, $p_{Tukey(3)} = .558$, or control condition, $p_{Tukey(3)} = .108$.

Because of the main effect of age, we examined 95% confidence intervals to determine when (if at all) children's responses in each condition first departed from chance. In the effort condition children mostly chose the high-cost option starting at age 5;11, $CI_{95\%}[0.52, 0.75]$, and in the sad condition starting at age 6;5, $CI_{95\%}[0.51, 0.73]$; choices in the control condition never differed from chance.[5]

Figure 2

Choices of the High-Cost Item in Experiment 1



Note. Participants saw two sunk costs scenarios. In each, they first answered a prompt question (effort, sadness, or control) and then predicted whether the agent in the scenario would keep a

[5] A model limited to trials where children chose the high-cost item in response to the prompt on their initial attempt yielded the same pattern: main effect of condition, $F(2, 313) = 4.05$, $p = .018$, a main effect of age, $F(1, 313) = 12.20$, $p = .001$, and no interaction, $F(2, 313) = 1.57$, $p = .211$.

high-cost (1) or low-cost (0) item. In all graphs, colored bands show 95% confidence intervals, and jittered points show individual participant's responses averaged across the two scenarios.

Discussion

Around age 6, children prompted to think about effort predicted that agents would keep high-cost objects. Children prompted to think about sadness also showed signs of predicting the bias. But findings in this condition are somewhat unclear since responses did not significantly differ from those in the other two conditions. When children were asked the control prompt question, they did not make sunk cost predictions and chose between the objects at chance.

These findings provide some support for the spontaneity account. The effect of prompting children cannot be readily explained by children using a low-level response strategy. For instance, it cannot be that the prompt simply worked by emphasizing the high-cost object, since the control prompt also emphasized this location but did not bring children to make sunk cost predictions. In the next experiment, we further test the spontaneity account by examining whether children will predict the sunk cost bias when prompted to think about waste.

Experiment 2

Methods

Participants. We tested 184 children aged 5-7 (M_{age} = 6;5, range = 5;0-7;11, 87 girls, 96 boys, 1 other; about 60 children per age in years). Four extra children were accidently tested: one in the Effort condition and three in the Waste condition).

Procedure. Children saw the same scenarios as before and were asked one of three prompt questions: effort, waste, or control (manipulated between-subjects). The effort prompt

was worded as in the first experiment, but we modified the control prompt to mention the agent. Here are the wordings from the scenario with the flowers:

> *Effort.* The girl worked hard to get both flowers. Which flower was harder for her to get?
>
> *Waste.* The girl feels like it was a waste to get both flowers. Which flower was more of a waste for her to get?
>
> *Control.* The girl climbed both hills to get the flowers. Which flower *did she get* from the bigger hill?

After the prompt question, children were asked which object the agent would keep.

Results

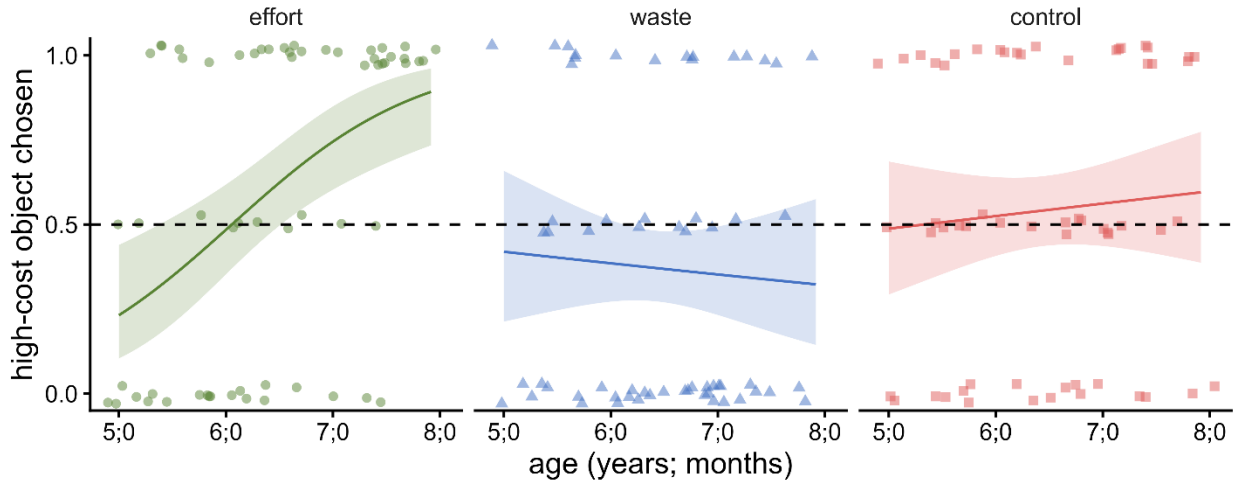
Children mostly chose the high-cost item when each prompt was initially asked: 97% for effort, 87% for waste, and 98% for the control. Once children who did not choose it were re-asked the prompts, the proportion went to 99% for effort and waste and 100% for control.

Turning to children's responses to the keep question, we entered choices of the high-cost (scored 1) and low-cost (scored 0) items into a condition by age GEE model; see Figure 3. There was a main effect of condition, $F(2, 361) = 4.48$, $p = .012$, a main effect of age, $F(1, 361) = 5.02$, $p = .026$, and an interaction, $F(2, 361) = 4.73$, $p = .009$. Overall, children more often selected the high-cost object in the effort than waste condition, $p_{\text{Tukey(3)}} = .014$, but choices did not significantly differ between the effort and control conditions, $p_{\text{Tukey(3)}} = .674$, or between the waste and control conditions, $p_{\text{Tukey(3)}} = .069$. The interaction resulted because choices of the high-cost object increased with age in the effort condition, $p < .001$, but were not affected by age in the waste or control conditions, ps $\geq .556$. In the effort condition, children first chose the high-cost item at rates exceeding chance at age 6;7, $CI_{95\%}$ [0.52, 0.76]. Single-sample tests revealed that children selected the high-cost object less than expected by chance in the waste condition

(37% of responses), $p = .021$, and at chance rates in the control condition (54% of responses), $p = .434$.[6]

Figure 3

Choices of the High-Cost Item in Experiment 2.



Note. Participants saw two sunk costs scenarios. After each, they first answered a prompt question (effort, waste, or control) and then predicted whether the agent in the scenario would keep a high-cost (1) or low-cost (0) item.

Discussion

Children prompted to think about effort again predicted the sunk cost bias. However, contrary to our expectations, children prompted to think about waste did not. Instead, they showed a reverse sunk cost effect and anticipated the agent would keep the low-cost object. One explanation for this surprising finding is that the prompt, "Which flower was more of a waste to

[6] A model limited to trials where children chose the high-cost item in response to the prompt on their initial attempt yielded the same pattern: main effect of condition, $F(2, 338) = 3.10$, $p = .046$, a main effect of age, $F(1, 338) = 5.50$, $p = .020$, and an interaction, $F(2, 338) = 5.29$, $p = .006$.

get?" could have led children to perceive the high-cost object as undesirable and not worth collecting (or having) in the first place.

In our final experiment, we followed-up on this possibility by using a different waste prompt. Instead of asking about which flower was more of a waste to collect, we asked about which would be a greater waste to throw away. For comparison, we again looked at the effect of prompting children to think about effort. We did not include 5-year-olds, though, because the results so far show that prompting does not bring them to make sunk cost predictions.

Experiment 3

Methods

Participants. We tested 120 children aged 6-7 (M_{age} = 6;11, range = 6;0-7;11, 62 girls, 58 boys; 60 children per age in years).

Procedure. Children saw the same scenarios as before and were asked one of three prompt questions: effort, waste, or control. In contrast with the waste prompt from Experiment 2, this prompt now asked about which item would be more wasteful to throw away. Also, to simplify the prompts, all were worded so that the subject was the item type (e.g., flower) rather than the agent. Here are the wordings from the scenario with the flowers:

Effort. The girl worked hard to get both flowers. Which flower *was* harder to get?

Waste. The girl feels like it's a waste to throw away both flowers. Which flower is more of a waste?

Control. The girl climbed both hills to get the flowers. Which flower is from the bigger hill?

After the prompt question, children were asked which object the agent would keep.

Results

Children again mostly chose the high-cost item when each prompt was initially asked: 100% for effort, 69% for waste, and 99% for the control. Once children who did not choose it were re-asked the prompts, the proportion was 100% for effort and control and 88% for waste.

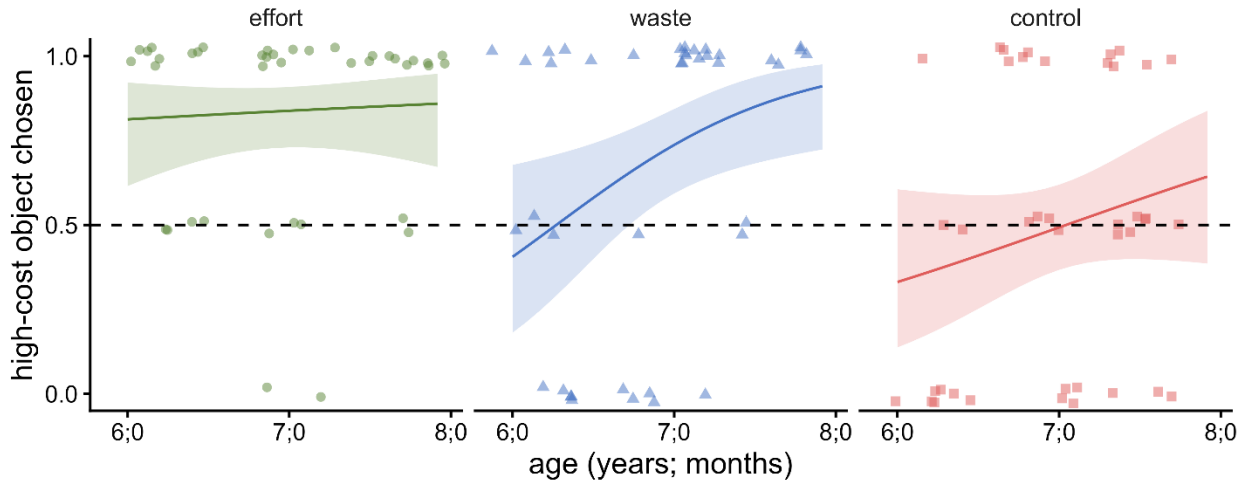
We entered children's predictions of whether the agent would keep the high-cost (scored 1) or low-cost (scored 0) item into an age by condition GEE. There was a main effect of condition, $F(2, 234) = 8.62$, $p < .001$, a main effect of age, $F(1, 234) = 6.64$, $p = .011$, but no interaction, $F(2, 234) = 1.50$, $p = .226$; see Figure 4. Children more often selected the high-cost object in the effort than control condition, $p_{\text{Tukey(3)}} < .001$, and in the waste than control condition, $p_{\text{Tukey(3)}} = .042$; responses did not differ between the effort and waste conditions, $p_{\text{Tukey(3)}} = .287$. Also, older children selected the high-cost object more than younger ones.

We examined 95% confidence intervals to determine when (if ever) children's responses in each condition first departed from chance. Children mostly selected the high-cost object in the waste condition by age 6;9, $CI_{95\%}$ [0.51, 0.79], and across all ages in the effort condition $CI_{95\%}$ [0.73, 0.91]. Responses in the control condition never differed from chance, $CI_{95\%}$ [0.36, 0.61].[7] It might seem that examining age separately across the conditions is unwarranted given that the interaction was non-significant. This would be true if we separately examined whether responses changed with age in each condition. The comparisons here instead pertain to when responses differed from chance, and for these collapsing by condition would be uninformative: The main effect of condition, taken together with the main effect of age, means that children's responses exceeded chance at different ages across the three conditions.

[7] A model limited to trials where children chose the high-cost item in response to the prompt on their initial attempt yielded the same pattern: main effect of condition, $F(2, 208) = 8.17$, $p < .001$, a main effect of age, $F(1, 208) = 6.87$, $p = .009$, and no interaction, $F(2, 208) = 1.76$, $p = .174$.

Figure 4

Choices of the High-Cost Item in Experiment 3



Note. Participants saw two sunk costs scenarios. After each, they first answered a prompt question (effort, waste, or control) and then predicted whether the agent in the scenario would keep a high-cost (1) or low-cost (0) item. In contrast with Experiment 2, here the waste prompt asked about which item was more of a waste to throw away.

Discussion

Children prompted to think about effort and waste predicted the sunk cost bias. Children who answered the control prompt, though, did not. In contrast with the earlier experiments, age did not significantly affect predictions in the Effort condition. This is likely because participants here were aged 6 and 7, whereas the other experiments also included 5-year-olds. The most important finding, though, was that the waste prompt now brought children to make sunk cost predictions. Taken together with the results from Experiment 2, this suggests that the effect of asking about waste depends on what aspect of it is highlighted.

General Discussion

Children saw scenarios where an agent could either choose to keep a high- or low-cost item, and were then asked a prompt question about effort, sadness, or waste. Children generally answered the prompt questions by choosing the high-cost item, which suggests some understanding of sunk costs. With age, answering these prompt questions also affected children's predictions about which object the agent would keep. Children made sunk cost predictions from around age 6 when first prompted to think about effort. In the first experiment, older 6-year-olds appeared to make sunk cost predictions when prompted to think about the agent's emotions (i.e., which item the agent would be sadder to lose). In the second and third experiments, asking children to think about waste had opposite effects on their predictions: Children made sunk cost predictions after considering which item would be more of a waste to throw away, but made opposite predictions when instead asked about which had been more of a waste to obtain. By contrast, children aged 5 did not make sunk cost predictions regardless of how they were prompted, and even those aged 7 did not make sunk cost predictions when asked a control prompt question about where the object had been obtained.

At first, these findings appear to fit with the spontaneity account which holds that children conceive of sunk costs much as adults do but do not make sunk cost predictions spontaneously. In line with this account, prompting 6-year-old children to think about effort and waste did bring them to make sunk cost predictions. Nonetheless, many findings fit with the opposing account which holds that children see sunk costs in a fundamentally different way than adults do. Consistent with this account, prompts had little or no effect on 5-year-olds. Also, even among older children, many did not go on to make sunk cost predictions after answering the prompts. For instance, even after saying the girl would be sadder to lose the high-cost item,

many children in the first experiment went on to predict she would instead keep the low-cost item.[8]

A puzzling finding

One puzzling finding was that children responded to waste in opposing ways based on how it was framed. In the third experiment, they made sunk cost predictions when asked which object was more wasteful-to-discard. But in the second experiment, they made predictions in the opposite direction when asked which object was more wasteful-to-obtain. This pattern could be explained by a low-level associative valence account. Identifying the high-cost object as wasteful-to-obtain could make children see *keeping* it as negative. By contrast, identifying the high-cost object as wasteful-to-discard could make children see *losing* it as negative. But this account cannot explain children's responses to the prompts about effort: Identifying the high-cost item as harder to obtain could have led children to view acquiring it as negative. It's also unclear why valence-based responding would be more common in older children but absent in younger ones.

Instead, the discrepant effects of asking children about waste could speak to how waste contributes to sunk cost predictions. Early theoretical work specified two ways people might see waste in sunk cost scenarios—in *underuse* and *overspending* (Arkes, 1996). With overspending, people see waste in not using (or fully using) the high-cost object, whereas with underuse, people see waste in the extra cost incurred for this object. This distinction may correspond to the two ways we asked about waste. Asking about which flower would be more wasteful to throw away may focus on underuse since it concerns not using or retaining an item. By contrast, asking about which was more wasteful to get likely focuses on overspending and unnecessary costs. The

[8] The Supplemental Materials include plots showing children's predictions split by how they answered the preceding prompt questions.

discrepant findings, then, suggest that waste in underuse is the more potent driver of sunk cost predictions, at least in childhood.

Origins of Sunk Cost Predictions

Why do younger children neglect sunk costs, even when prompted to think about factors that could support sunk cost predictions? And what leads older children to start making these predictions (at least when prompted)? Although many answers are possible, we consider two kinds of accounts.

One account holds that children's sunk cost predictions rest on their awareness that their own behavioral choices are affected by sunk costs. On this account, younger children do not make sunk cost predictions because their own behavioral choices are not affected by sunk costs, or because they are not yet aware that their choices are affected by sunk costs. Children's own choices might only become biased by sunk costs as they come to see effort and other resources as limited and budgetable. But this might be a relatively late development (Webley & Lea, 1993), and could depend on enculturation.[9] Children are gradually exposed to messages about managing resources effectively, both through direct instruction and by observing others' behaviors (Clark et al., 2005; Danes, 1994; Gudmunson & Danes, 2011; Jorgensen & Savla, 2010; for a review, see Kamber et al., 2024). Parents and teachers help children learn about budgeting and model how effort should be allocated. For instance, children might be explicitly told, "If you spend too much time on this, then you won't have time to do that", or "It's too bad that it didn't work because we worked so hard on it". Exposure to this messaging may increase in later childhood as parents start discussing saving and allowances (e.g., Danes, 1994; Furnham,

[9] While young children, and even infants, do consider costs and benefits when deciding how to exert effort (e.g., Leonard et al., 2017, 2023; Lucca et al., 2020; Paulus et al., 2015; Sommerville et al., 2018; Radovanovic et al., 2025), this work does not show whether they see effort and other resources as budgetable.

1999; Gudmunson & Danes, 2011; Warton & Goodnow, 1995). These experiences may expose children to deliberate trade-offs between costs and rewards and may come to feel loss when efforts return little reward. This could lead to sunk cost reasoning: To cope with the disappointment of lost or wasted effort, people may frame future actions as diminishing and minimizing the loss.

Some work does suggest that sunk costs first affect children's behavioral choices starting at around age 6. In one study, 4-6-year-olds completed tasks to earn stickers and could then distribute some stickers to an unfamiliar recipient. By age 6, children distributed fewer stickers if the initial tasks were hard and effortful rather than easy (Benozio & Diesendruck, 2015). However, other studies find that children are unaffected by the efforts invested in obtaining things (Kiefer et al., 2023; Marsh et al., 2018, Experiment 2). Regardless, even if children aged 6 are themselves biased by sunk costs, they may not be wholly aware of this. So, the effect of prompts on sunk cost predictions could hinge on children reflecting on their own experiences and then using this to predict how others will act.

The other account we consider is that cost predictions rest on developments in theory of mind (also see Howard et al., 2024). By age 4 or 5, children expect people to act rationally given their beliefs, desires, and knowledge of the costs of different courses of action (e.g., Jara-Ettinger et al., 2016; Leslie et al., 2005; Rakoczy, 2022). But young children may struggle to understand irrational actions. In line with this, children under age 6 have difficulty predicting that agents will act in habitual (but sub-optimal) ways (Goldwater et al., 2020). Younger children, then, might not see how sunk costs could sway predictions because rational agents would not be swayed this way.

A related account is that developmental changes in children's predictions reflect a broadening in the considerations they see as relevant for people's choices and preferences. Young children recognize that choices of objects often depend on people's desires and preferences and that these differ across people (Ahl & Dunham, 2020; Wellman & Liu, 2004; Wellman & Woolley, 1990). Young children also know that these choices depend on factors that affect object value (for a review see Pesowski et al., 2022). These factors include: physical features of objects, such as their size, color, and shape (e.g., Fawcett & Markson 2010; Lehman et al. 1995; Ma & Xu 2011); their uniqueness and scarcity (Echelbarger & Gelman, 2017; Ferera et al., 2020; Sehl et al., 2022; Smith-Flores et al. 2021); and aspects of their histories, such as an object having been owned by a celebrity (e.g., DeJesus et al., 2022; Gelman et al., 2015; Hartley et al., 2025; Hood & Bloom, 2008). Sunk costs differ from these considerations because they are not indicative of an agent's desires and preferences[10], or an object's value. It is an open question, though, what changes in children's conceptions of agents and objects would bring them to incorporate sunk costs into the factors that sway actions.

Constraints on Generality

In our experiments, children considered scenarios where agents spent effort to obtain material items. Children might see things differently, though, if the costs themselves were material goods. For instance, children might make sunk cost predictions earlier (or might be more sensitive to prompting) if resources like stickers or toys were traded for other items. Children might find it easier to think about material costs because they are perceptible and

[10] Young children do recognize that agents are more willing to incur costs to obtain highly desired over less desired objects (Jara-Ettinger et al., 2015). But as we noted in the Introduction, this information is not provided in sunk cost scenarios. For instance, in our scenarios, children learned the agent incurred more costs obtaining one object than the other. But they were *not* given evidence that the agent would have been unwilling to incur the same cost for the low-cost item.

continue to persist after being spent—even after stickers are traded for some other item, the stickers are still somewhere. Children might also be more sensitive to these kinds of sunk costs because they critically think about how material resources are spent (e.g., Echelbarger et al., 2020; Harris et al., 2001; Hartley & Fisher, 2018; Webley & Lea, 1993).

Our experiments used *adoption* sunk cost scenarios. In the situations, an agent incurs costs to secure two or more items but later has to choose between them. Much as children in our studies considered choices between flowers and between rocks, adults in earlier work considered choices between TV dinners and between ski vacations (e.g., Arkes & Blumer, 1985). These sunk cost situations are contrasted, though, by *progress* situations (Moon et al., 2001; Roth et al., 2015). In these, an agent incurs costs pursuing a goal or activity but is later faced with some obstacle or drawback. Here predictions concern whether the agent will persist (reflecting a sunk cost bias) or switch to a new course of action (no bias). In line with our findings, recent work finds that children do not make sunk cost predictions in these scenarios (Hamzagic et al., 2025; also see Sehl et al., 2024, Experiment 2). But it is an open question whether children would show signs of caring about sunk costs in progress situations if prompted to consider waste or the agent's effort. Further investigating children's judgments about progress situations might also help address any lingering concerns with our adoption scenarios of participants thinking the agent preferred the high-cost item from the start, even before expending energy to obtain it. This may be less of an issue in progress scenarios since they do not typically involve choices between similar goal items.

Greater constraints on generalization relate to culture and scarcity. We tested children in a Western country—the kind of population where sunk cost predictions have almost exclusively been investigated in adults. The little work which has examined cultural differences in the sunk

cost bias found some variation between individualist and collectivist societies (Yoder et al., 2014), and it is entirely possible that our findings would not extend to other cultures. Indeed, known variations between cultures suggest we should expect differences. One important difference relates to the availability of resources. Scarcity of resources makes people more likely to interpret everyday experiences as involving costs (Shah et al., 2018) and may reduce their tolerance for unexpected losses (Amir et al., 2018). Recalling experiences of scarcity brings also children and adults to conserve more resources (Ahl et al., 2024; Roux et al., 2015). Hence, experiencing scarcity might make children more to see sunk costs as wasteful. In line with this, adults who had low socioeconomic status as children are more likely than those who had higher socioeconomic status to make sunk cost predictions and to perceive sunk costs as wasteful (Jhang et al., 2022).

Cultures also differ in their norms about avoiding material waste (Chia et al., 2024; Mintz et al., 2019) and in their tolerance for wasting time and effort (Allen et al., 2025; Bellezza et al., 2017; Brislin & Kim, 2003). For example, children from China may be less willing than Western children to waste resources (Choshen-Hillel et al., 2019; Zhang & Benozio, 2021). These differences may again support the expectation that development of sunk cost predictions might emerge earlier in some non-Western cultures.

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