Received: 30 April 2023 | Revised: 7 February 2024 | Accepted: 23 February 2024

DOI: 10.1111/desc.13496

Developmental Science WILEY

SHORT REPORT

How barriers become invisible: Children are less sensitive to constraints that are stable over time

Jamie Amemiya[1] | Gail D. Heyman[2] | Caren M. Walker[2]

[1]Department of Psychology, Occidental College, Los Angeles, USA

[2]Department of Psychology, University of California, San Diego, USA

Correspondence
Jamie Amemiya, Department of Psychology, Occidental College, 1600 Campus Rd, Los Angeles, CA 90041, USA.
Email: amemiya@oxy.edu

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the National Science Foundation.

Abstract

When making inferences about the mental lives of others (e.g., others' preferences), it is critical to consider the extent to which the choices we observe are constrained. Prior research on the development of this tendency indicates a contradictory pattern: Children show remarkable sensitivity to constraints in traditional experimental paradigms, yet often fail to consider real-world constraints and privilege inherent causes instead. We propose that one explanation for this discrepancy may be that real-world constraints are often stable over time and lose their salience. The present research tested whether children (N = 133, 5- to 12-year-old mostly US children; 55% female, 45% male) become *less* sensitive to an actor's constraints after first observing two constrained actors (Stable condition) versus after first observing two actors in contexts with greater choice (Not Stable condition). We crossed the *stability* of the constraint with the *type* of constraint: either the constraint was deterministic such that there was only one option available (No Other Option constraint) or, in line with many real-world constraints, the constraint was probabilistic such that there *was* another option, but it was difficult to access (Hard to Access constraint). Results indicated that children in the Stable condition became less sensitive to the probabilistic Hard to Access constraint across trials. Notably, we also found that children's sensitivity to constraints was enhanced in the Not Stable condition regardless of whether the constraint was probabilistic or deterministic. We discuss implications for children's sensitivity to real-world constraints.

KEYWORDS
constraints, preferences, social inference

Research Highlights

- This research addresses the apparent contradiction that children are sensitive to constraints in experimental paradigms but are often *insensitive* to constraints in the real world.
- One explanation for this discrepancy is that constraints in the real world tend to be stable over time and may lose their salience.
- When probabilistic constraints (i.e., when a second option is available but hard to access) are stable, children become de-sensitized to constraints across trials.

- First observing contexts with greater choice increases children's sensitivity to both probabilistic and deterministic constraints.

1 | INTRODUCTION

When making inferences about the mental lives of others from the choices we observe, it is critical to consider their constraints. In particular, observers should recognize that a choice made from limited options provides incomplete information about a person, as the choice could have been based on the person's desires *or* due to the fact there were few options available (Eason et al., 2018; Jara-Ettinger et al., 2015; Kushnir et al., 2010; Pesowski et al., 2016; Wong et al., 2023). Not only is understanding the causal ambiguity of constrained choices important for navigating daily social life, but it is also foundational for understanding more complex social issues. Specifically, recognizing societal constraints can help mitigate the formation of negative, inaccurate stereotypes (e.g., Amemiya et al., 2023; Peretz-Lange et al., 2021; Vasilyeva et al., 2018). For example, acknowledging low-income families' constraints in the education system can mitigate the interpretation that lower educational attainment rates reflect deeply held values or the lack of a preference for higher education (Browman et al., 2019).

Previous developmental literature offers a contradictory view of children's tendency to consider constraints. On the one hand, experimental paradigms reveal that children show a remarkably early capacity to understand the ambiguity of constrained choices. In the traditional constraint paradigm, children observe an agent select a toy over one that is out of reach (Jara-Ettinger et al., 2015; Pesowski et al., 2016), or an agent selects a toy in which there is no other option available (Garvin & Woodward, 2015; Kushnir et al., 2010). This body of research indicates that by at least age 5, and in some cases even younger, children refrain from inferring a preference when observing constrained actions.

In contrast, there is a wide body of literature indicating that children privilege intrinsic causes for many behaviors they observe in the real world, *despite* the presence of constraints (Cimpian & Salomon, 2014; Rhodes & Mandalaywala, 2017). We sought to test one explanation for this discrepancy. Given that a common feature of real-world constraints is that they tend to be more stable (e.g., low-income children's environmental conditions, such as their school and neighborhood contexts, often remain stable) relative to other observable factors like a person's effort, we propose that these constraints lose their salience as a causal factor. The present study adapted the established constraint paradigm to test if children 5- to 12-years-old make preference inferences about constrained individuals when constraints are stable.

Findings from the adult literature on causal attribution support the hypothesis that constraints become less causally salient when they are stable. Specifically, people are less likely to attribute causal outcomes to stable factors compared to factors that are more variable, even when both factors are relevant causes (Cheng & Novick, 1991; Hilton & Slugoski, 1986). Kirfel and Lagnado (2021) describe two incidents that highlight this tendency: When explaining what caused a dust explosion in a warehouse, people were less likely to cite the presence of dust particles (a stable factor) and more likely to reference a dropped cigarette (the factor that is more variable in this context). This attribution is reversed for contexts where smoking is more common than dust: When explaining what caused a dust explosion at a music festival, people were less likely to cite attendees' cigarette smoking (a stable factor) and more likely to attribute the explosion to the spray of a combustible powder (the more variable factor).

While the causal attribution literature describes how stability can make environmental factors more or less salient, research on the inherence heuristic suggests that environmental causes are *generally* not salient to people (Cimpian & Salomon, 2014; Horne et al., 2019). This work finds that when children and adults are not reminded or informed about environmental causes, they tend to be biased toward inherent explanations that focus on intrinsic properties of the person or object (Salomon & Cimpian, 2014; Sutherland & Cimpian, 2019). Here, we integrate these two proposals: We posit that children will be less attentive to constraints that are stable over time (in line with theories of causal attribution), and the fact that constraints are *generally* stable in the real world may contribute to children's common tendency to neglect environmental causes (in line with the inherence heuristic).

Embedded in our proposal is the claim that children may be more sensitive to constraints when they are *not stable*. To return to the traditional developmental paradigm assessing children's sensitivity to constraints, we propose that constraints may be more salient after first observing a contrasting, unconstrained context that offers great choice. This contrast between constrained and unconstrained contexts may help children keep the relevant counterfactual in mind, specifically that the *environment* could have been designed to provide greater choice and the constrained actor may have chosen differently under these conditions (see also Amemiya et al., 2023). As a result, children may recognize that a constrained choice is causally ambiguous and refrain from inferring a preference.

Contrasts have been shown to scaffold more sophisticated reasoning across a range of domains (see Namy & Clepper, 2010). For example, 4- and 5-year-olds are able to recognize when a teacher is providing underinformative instruction if they *first* observe a more informative teacher, but they fail to do so without this contrast (Gweon & Asaba, 2018). Relatedly, 3- and 4-year-olds generally reject testimony from an inaccurate informant when it is presented in contrast with testimony from a more accurate informant, but they will *accept* this testimony in the absence of a conflicting viewpoint (Vanderbilt et al., 2014). A similar effect is found in children's pragmatic reasoning: 5-year-olds correctly infer that "some" implies "not all" when they first hear "all" in the proper

context, but misinterpret "some" to mean "all" without this contrast (Skordos & Papafragou, 2016). Research in the social domain also finds that when children are presented with contrasted social groups (e.g., Zarpies vs. Gorps), statements about one of the groups' traits (e.g., Zarpies' pizza-baking abilities) implies that the contrasting group (e.g., Gorps) *lacks* this trait (Baharloo et al., 2023; Moty & Rhodes, 2021).

Notably, with respect to constraints, some of the prior research may have inadvertently included scaffolds that facilitated children's reasoning. In a study by Pesowski et al. (2016), the constrained toy that was out of reach was more physically attractive than the chosen toy that was in reach, perhaps highlighting that picking the less attractive toy did not necessarily reflect the agent's preference. Most relevant to the current study, Jara-Ettinger et al. (2015) found that 5- and 6-year-olds successfully refrained from inferring preferences from constrained actions, but children always observed what the actor chose when constrained, and critically, the contrast of what the actor chose in an unconstrained context with greater choice.

We also consider two additional factors: constraint type and children's age. Specifically, we examined two types of constraints used in prior work: when a second option was *hard to access*, that is, a probabilistic constraint that lowers the chances of accessing the other option, and when there was *no other* option, that is, a deterministic constraint that completely precludes access to another choice (see Amemiya et al., 2021; Garvin & Woodward, 2015; Jara-Ettinger et al., 2015; Kushnir et al., 2010; Pesowski et al., 2016). This question is particularly relevant for understanding real-world constraints, given that societal constraints tend to be probabilistic rather than deterministic (e.g., societal barriers weaken but do not completely preclude low-income children's chances for higher education).

We further propose a potential interaction between stability and constraint type, in which stable constraints may be more likely to de-sensitize children to constraints when the constraint type is *probabilistic*—that is, when there *is* a second option available, but it is hard to access. For such probabilistic constraints, children can reason that the *actor* could have acted differently (e.g., exerted more effort to get the other option) rather than focus on how the environment could have been different. In turn, children may infer that the choice to remain constrained may reflect a preference for that option (see also Amemiya et al., 2023). For constraints that are deterministic—that is, when there is *no* second option available—children may readily pick up on the notion that the actor had essentially no choice beyond refusing to accept any option at all, regardless of constraint stability. In line with this possibility, children are more sensitive to physical constraints than social constraints, which may be due, in part, to their perception that physical but not social constraints are deterministic (Pesowski et al., 2016).

We also explore whether the effect of stable constraints on preference inferences interacts with children's age. We consider three possible results. On the one hand, observing the contrast between constrained and unconstrained contexts may be more beneficial to *younger* children, given that they have more difficulty with constraint reasoning in general (see also Gweon & Asaba, 2018; Pesowski et al., 2016). On the other hand, this contrast may be more beneficial to *older* children, given existing findings that older children's attention to constraints can vary depending on the context (e.g., it weakens when they reason about stereotypical choices; Amemiya et al., 2021). A third possibility is that there are *no* age differences, as stability may make it equally challenging for younger and older children to notice the causal relevance of constraints, similar to how adults tend to neglect stable factors when making causal judgments (Cheng & Novick, 1991; Hilton & Slugoski, 1986). We included a wide age range (5 to 12 years) to test these possibilities.

2 | THE PRESENT STUDY

The present study adapted the traditional constraint paradigm to examine whether children become less sensitive to constraints when they are stable over time (i.e., over three trials). We addressed this question in three steps. First, we tested if children become less sensitive to constraints on the *third* trial compared to the *first* trial in the Stable condition (i.e., children who only observed constrained choices), which would indicate that constraints lose their salience when they are stable over time. Second, we compared children's inferences on the third trial in the Stable condition to the Not Stable condition (i.e., children first observe two actors in unconstrained contexts with greater choice). If we find that children are less sensitive to constraints in the Stable than Not Stable condition, this would rule out the possibility that children simply become inattentive after observing any three choices in a row. Third, to test if the Not Stable condition *enhances* children's sensitivity to constraints, we examined whether children were more sensitive to constraints in the third trial (i.e., after observing actors in less constrained contexts) compared to the first trial in the Stable condition (i.e., the first observation of a constrained choice).

Although the stability effects were our main focus, we also explored whether these effects interacted with constraint type (a probabilistic [*Hard to Access*] versus deterministic [*No Other Option*] constraint) and children's age (5 to 12 years old). While we expected that stable constraints may negatively impact children's reasoning about both types of constraints and across ages, we explored whether the effect was stronger for the probabilistic Hard to Access (vs. No Other Option) constraint and whether the effect was moderated by age. Data (including children's raw, open-ended responses prior to coding), code, and study materials used in the present research are openly available at: https://osf.io/wc6av/.

3 | METHOD

3.1 | Participants

Participants were 133 children, aged 5 to 12 years, recruited via online platforms, including social media and ChildrenHelpingScience.com (M = 8.68 years, SD = 2.07; 55% female, 45% male; 54% White, 33% Asian, 5% Latine/x, 3% Multiracial, and 5% did not report or reported Other; 91% from the United States, 2% from the United Kingdom,

2% from India, 2% from Canada, 2% from Israel, <1% from Mexico). An initial power analysis indicated that a sample size of 88 would be sufficient to detect a medium effect size of the Stable vs. Not Stable conditions (Cohen's $w = 0.30$, alpha = 0.05, power = 0.80). We increased the sample size to explore potential differences by constraint type and child age. All interviews were conducted in English, with the exception of one interview that was conducted in Spanish. An additional three participants were excluded from analyses because of parental interference. All procedures were approved by the Institutional Review Board at the University of California, San Diego and informed consent was obtained for all participants. The study was conducted from May to September 2020.

3.2 | Procedure and measures

Children were tested in a live Zoom session by an experimenter who narrated an animated PowerPoint presentation. Participants were randomly assigned to one of four between-subjects conditions (Constraint Stability [Stable vs. Not Stable] x Constraint Type [Hard to Access [Probabilistic] vs. No Other Option [Deterministic]): (1) *Stable/Hard to Access (Probabilistic); (2) Not Stable/Hard to Access (Probabilistic); (3) Stable/No Other Option (Deterministic); (4) Not Stable/No Other Option (Deterministic)*. See Figure 1 for all conditions.

Children observed toy choices that featured three different actors named Bailey, Sam, and Cody. Of central interest was the children's reasoning about the final actor, Cody, who made a constrained choice. In the Stable condition, children observed the first two actors make their toy selections in constrained contexts with limited choice, and thus *only* saw constrained contexts. In the Not Stable condition, children observed the first two actors make their toy selections in less constrained contexts with greater choice (i.e., these actors had access to both toy options) before seeing the final constrained actor. With respect to constraint type, the context was constrained either because the second toy option was Hard to Access (Probabilistic) or because there was No Other Option (Deterministic).

We made several design decisions to ensure that constrained choices were uninformative. First, we informed participants that the teacher told the protagonist that they *had* to pick a toy, and since there was little possibility of refraining from choosing, selecting the only toy available yields minimal information about the actor's desires. We also had a comprehension check after each scenario to ensure children understood the constraint or lack thereof (i.e., children were asked which shelf the protagonist could reach or which toys were available); children passed this check on 99% of the trials.

Finally, each of the scenarios featured *different* protagonists (i.e., Bailey, Sam, and Cody), which had several benefits. First, children had no information about the final protagonist (e.g., whether Cody typically takes what is available), again reducing the information they have about the protagonist's preferences. Second, this allowed for a more stringent test of the condition effect—we could determine whether viewing stable constraints more generally reduces sensitivity to constraints on a novel individual's choice.

Below are the three scenarios for the Hard to Access (Probabilistic) constraint (see Appendix for the No Other Option [Deterministic] version). We have bolded the text that was manipulated across the Stable versus Not Stable condition:

[Trial 1]

Here is a girl named Bailey and today is her first day at school. At Bailey's school there is a short toy shelf and a tall toy shelf. Bailey is really small, and she can only reach toys from the short shelf. Can you remind me, which shelf can Bailey reach toys from?

For the first activity of the day, the teacher tells Bailey that she *has* to pick *one* toy. First Bailey sees this boat. This boat is on the shorter one and she can reach it. Then Bailey sees this plane. This plane is **[also on the shorter one and she can reach it/way up on the taller one and she cannot reach it]**. Then Bailey takes the boat. Now I have a question for you. Do you think that Bailey likes the boat *more* than the plane? Why is that?

[Trial 2]

Here is a girl named Sam and today is her first day at school (a different-colored school is shown). At Sam's school there is a short toy shelf and a tall toy shelf. Sam is *also* really small, and she can only reach toys from the short shelf. Can you remind me, which shelf can Sam reach toys from?

For the first activity of the day, the teacher tells Sam that she *has* to pick *one* toy. First Sam sees this basketball. This basketball is on the shorter one and she can reach it. Then Sam sees this baseball. This baseball is **[also on the shorter one and she can reach it/way up on the taller one and she cannot reach it]**. Then Sam takes the basketball. Now I have a question for you. Do you think that Sam likes the basketball *more* than the baseball? Why is that?

[Trial 3: Always a constrained actor]

Here is a girl named Cody and today is her first day at school (a different-colored school is shown). At Cody's school there is a short toy shelf and a tall toy shelf. Cody is *also* really small, and she can only reach toys from the short shelf. Can you remind me, which shelf can Cody reach toys from?

For the first activity of the day, the teacher tells Cody that she *has* to pick *one* toy. First Cody sees this circle toy. This circle toy is on the shorter one and she can reach it. Then Cody sees this triangle toy. This triangle toy is way up on the taller one and she cannot reach it. Then Cody takes the circle toy. Now I have a question

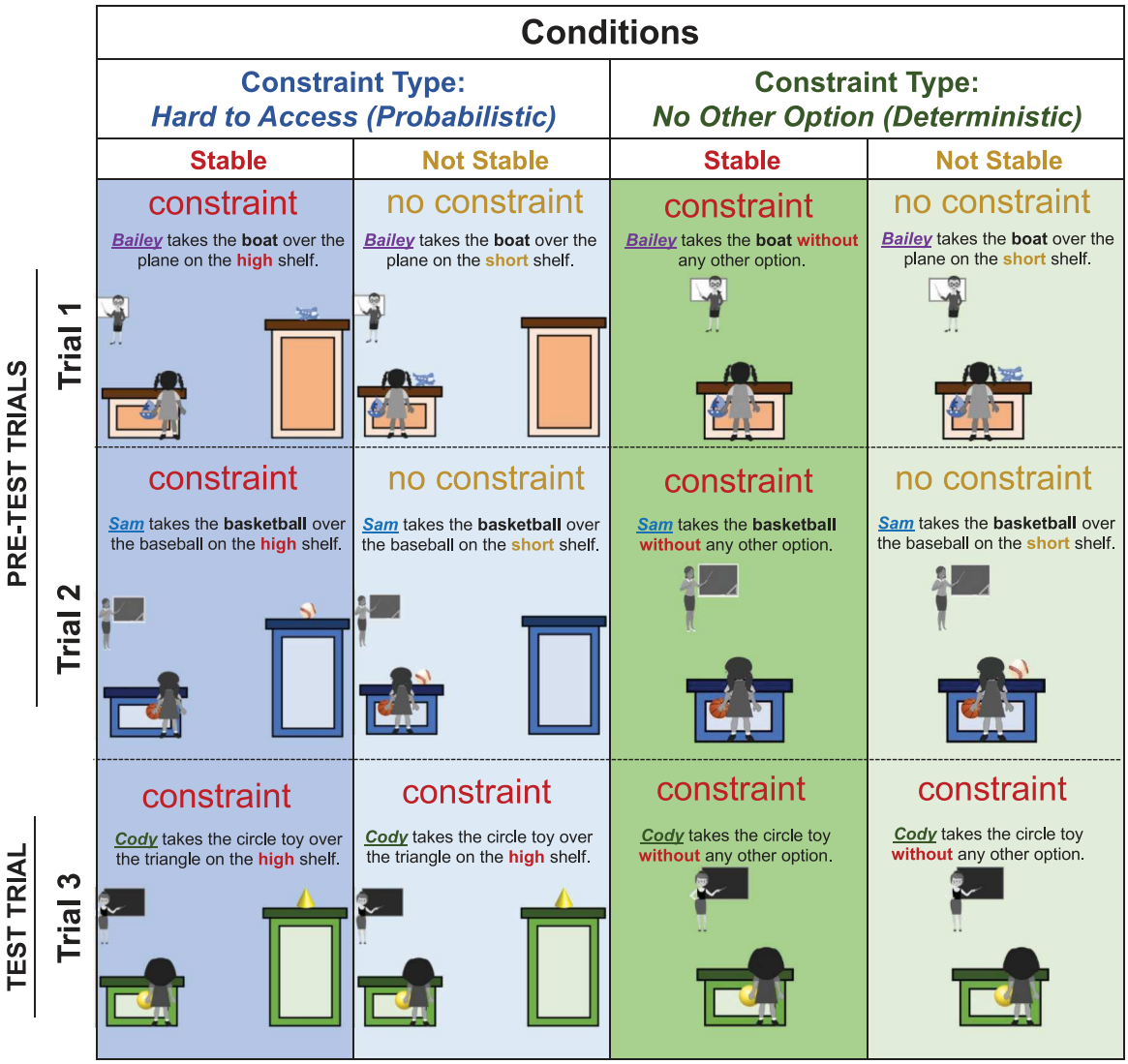

FIGURE 1 Four between-subject conditions (Constraint Stability [Stable vs. Not Stable] X Constraint Type [Hard to Access vs. No Other Option]).

for you. Do you think that Cody likes the circle toy *more* than the triangle toy? Why is that?

Dependent measure: Sensitivity to constraints (i.e., correct inference). We coded children as showing sensitivity to constraints (which we also refer to as making the "correct inference") if they (a) refrained from inferring a preference when asked about the actor's preference for the selected toy (i.e., saying negative answers such as "no" or "I don't know"; Cohen's $\kappa = 0.98$), and (b) mentioned the constraint as the reason (i.e., mentioning the shelf in the Hard to Access version, "Because Cody cannot reach the higher shelf, so she can only pick the circle toy," or lack of choice in the No Other Option version, "Because the triangle toy wasn't on the toy shelf"; Cohen's $\kappa = 0.92$). We coded whether children made this correct inference (1 = yes, 0 = no) on trials 1, 2, and 3 in the Stable condition and on trial 3 in the Not Stable condition (i.e., all trials in which the actor made a choice in a constrained context).

We note several decisions in defining this dependent measure. First, we asked the preference question directly so children could explicitly state their judgment about the key issue at hand: whether the actor prefers the selected toy *over* the unselected toy. This approach contrasts with previous research that forces children to choose which toy the actor likes (e.g., Pesowski et al., 2016), with the logic being that randomly selecting a toy (i.e., chance performance of 50%) indicates that children are refraining from inferring a preference. In our case, we do not rely on chance performance because *all* children could respond with answers such as "no" or "I don't know" if they refrained from inferring a preference. In addition to better understanding children's inferences, our approach helped to mitigate the pragmatic inference that the participant *should* choose one of the toys as being more preferrable, and in turn rely on the information that they were given (i.e., a constrained choice) despite considering it to be uninformative.

Second, we included children's *justification* as part of the dependent measure to ensure that children were not making preference

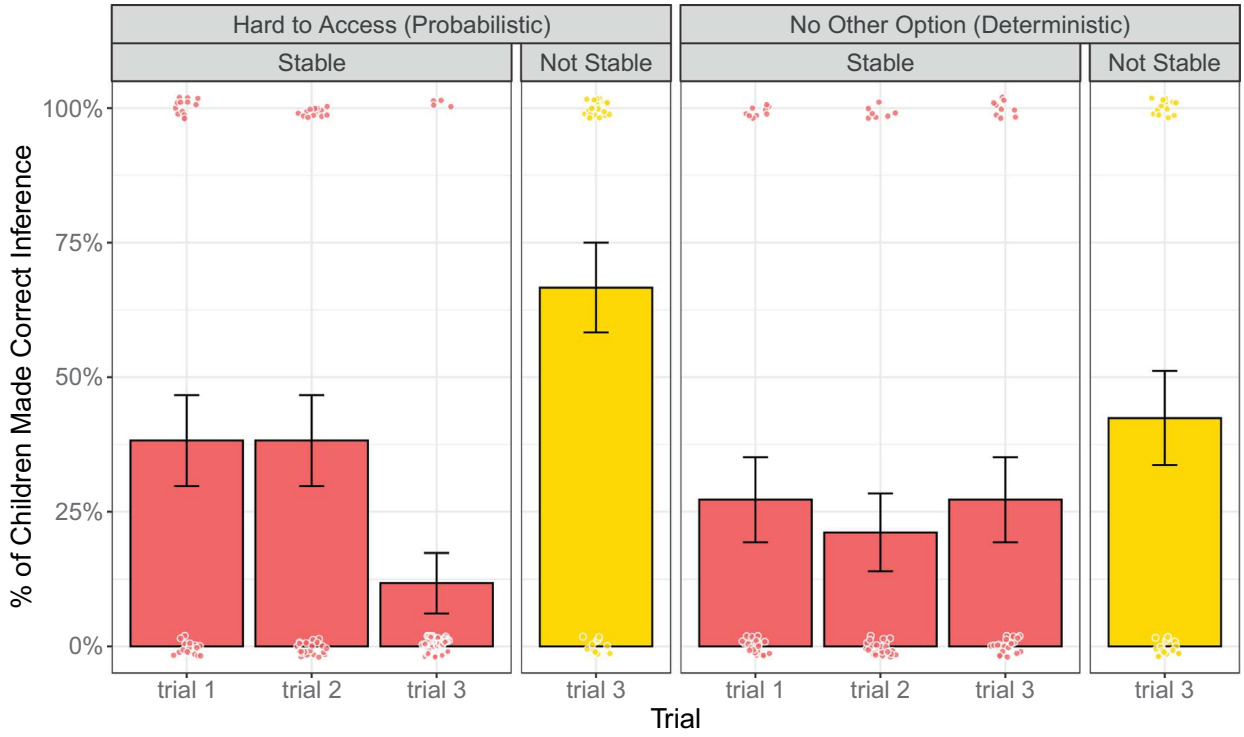

FIGURE 2 Percent of children making the correct inference after observing constrained choices—that is, refraining from inferring a preference and mentioning the constraint as justification (trials 1–3 for Stable condition; trial 3 for Not Stable condition). Means and 95% CIs around means are reported. Raw data are presented in pink and yellow points.

judgments based on idiosyncratic reasons. A logistic regression indicated that these two measures were strongly related, such that children who refrained from inferring a preference were *more* likely to mention the constraint, $B = 2.56$, $p < 0.001$, 95% CI [1.99, 3.16], $OR = 12.91$. For parsimony, we focus on the combined measure (i.e., the "correct inference") in our results. However, we also ran the analyses for preference inferences and justifications separately and found the same overall pattern of results (see Supplemental Materials).

4 | RESULTS

Figure 2 shows the percent of children who made the correct inference (i.e., showed sensitivity to constraints) across trials 1, 2, and 3 for the Stable condition and trial 3 for the Not Stable condition; results are split by constraint type (Hard to Access/Probabilistic constraint and No Other Option/Deterministic constraint).

4.1 | Trial effect in the stable condition

To examine whether constraints became less salient over time, we examined whether children in the Stable condition were less likely to make the correct inference at trial 3 than at trial 1. We found a significant interaction between trial number and constraint type, $B = 12.88$, $p < 0.001$, 95% CI [5.38, 20.37]. As shown in Figure 2 (see the pink bars), sensitivity to constraints significantly *decreased* from trial 1 (38%) to trial 3 (11%) for the Hard to Access (Probabilistic) constraint, $B = -12.88$, $p < 0.001$, 95% CI [−19.38, −6.38], but not for the No Other Option (Deterministic) constraint (both 27%), $B = 0.00$, $p = 1.00$, 95% CI [−3.73, 3.73].

Importantly, there was no interaction between these factors (i.e., trial and constraint type) and age. This suggested that the decrease in sensitivity from trials 1–3 within the Hard to Access (Probabilistic) condition was consistent across 5- to 12-year-olds. Indeed, exploratory analyses within this condition that split the sample by younger (5 to 8 years old) and older children (9 to 12 years old) found the decreasing trend for both younger children, trial 1: 24% to trial 3: 0%; and for older children: 53% to trial 3: 24%. This indicates that children across ages become less sensitive to (probabilistic) constraints that are stable over time.

4.2 | Constraint stability effects on final preference inference (trial 3)

To rule out that children simply become de-sensitized to constraints after observing *any* three choices in a row, we compared performance on trial 3 in the Stable to the Not Stable condition. Specifically, we ran a logistic regression predicting children's tendency to make the correct inference at the final trial (Trial 3) as a function of constraint stability (Stable = 1; Not Stable = 0), constraint type (No Other Option

[Deterministic] = 1; Hard to Access [Probabilistic] = 0), age (centered at the mean age, 8.68 years), and the interaction between these factors.

The logistic regression indicated a significant interaction between constraint stability and constraint type, $B = 2.62$, $p < 0.05$, 95% CI [0.63, 4.91]. We then dropped nonsignificant interaction terms (e.g., interactions with age) from the model and probed this two-way interaction. As shown in Figure 2 (see Trial 3, pink vs. yellow bars), children were less likely to make the correct inference in the Stable versus the Constraint Not Stable condition when reasoning about the Hard to Access (Probabilistic) constraint, $B = -3.53$, $p < 0.001$, 95% CI [−5.20, −2.11]. Although the stability effect went in the same *direction* for the No Other Option (Deterministic) constraint, it was not statistically significant, $B = -0.83$, $p = 0.17$, 95% CI [−2.05, 0.35]. These results indicate that children are uniquely de-sensitized to constraints (for the Hard to Access [Probabilistic] constraint type) when constraints are *stable* across the three trials, as opposed to children simply becoming inattentive whenever completing any three trials in a row.

4.3 | Enhancing sensitivity to constraints

Finally, we examined whether children's sensitivity to constraints is *enhanced* in the Not Stable condition by comparing performance on the third trial in this condition (the yellow bar) to performance on the first trial in the Stable condition (the first pink bar). We again ran a logistic regression predicting children's constraint sensitivity at these trials as a function of stability (Stable = 1; Not Stable = 0), constraint type (No Other Option [Deterministic] = 1; Hard to Access [Probabilistic] = 0), age (centered at the mean age, 8.68 years), and the interaction between these factors.

Results indicated no significant interactions between these factors. Instead, we found an overall main effect of constraint stability, $B = -0.90$, $p < 0.05$, 95% CI [−1.69, −0.14]. This suggests that, in addition to children's sensitivity to constraints being *weakened* when constraints are stable (as found in the first two sets of analyses), this sensitivity can be *enhanced* if children first observe actors in unconstrained contexts with greater choice.

5 | DISCUSSION

The present research addressed the contradictory finding that children robustly attend to constraints in experimental paradigms but often fail to do so in the real world. We proposed that one explanation for this discrepancy is that real-world constraints tend to be stable over time and lose their salience. Consistent with this hypothesis, we found that adapting the traditional paradigm to align with the presence of stable constraints in the real world reduces children's sensitivity to constraints over three trials. We find that this stability effect is specific to probabilistic constraints (when there *is* another option, but it is hard to reach), rather than deterministic constraints (when there is no other option at all). However, we found that regardless of constraint type, children show *enhanced* sensitivity to constraints when they first observe actors in unconstrained contexts with greater choice. We found that these effects did not interact with children's age (i.e., 5 to 12 years old), suggesting that these processes may be consistent across early to middle childhood.

We find support for the hypothesis that observing stable constraints over time reduces their salience, specifically for the probabilistic, hard to reach constraint. Broadly, these results align with prior studies finding that children have greater difficulty in making correct inferences when they do not have the relevant contrast in mind (Gweon & Asaba, 2018; Namy & Clepper, 2010; Skordos & Papafragou, 2016; Vanderbilt et al., 2014). We posit that when constraints are a stable feature of the environment, children may fail to consider constraints as a difference-maker for the agent's actions (see also Goddu & Gopnik, 2020) and instead default to intrinsic explanatory causes such as the actor's preferences (Hussak & Cimpian, 2015).

In explaining why stability was problematic specifically for the probabilistic, hard to access constraint, we propose that children may have reasoned counterfactually that the *actor* could have tried harder to get the other toy option if they strongly preferred it. That is, across trials children may have shifted their attention away from environmental constraints and more toward the *agent's* possible actions. Indeed, by the third trial, some children stated that the actor could have asked the teacher for help if she really wanted the other option (see Amemiya et al., 2023 for how certain narratives, such as those about persistence, can further exacerbate this tendency). Yet inferring a preference is still unwarranted: Even if the actor chooses not to expend the energy to obtain the hard to access toy, it could be that the actor prefers both toys equally but selected the toy that has a lower cost to acquire it (Jara-Ettinger et al., 2016).

Another reason the stability effects may have been stronger for the probabilistic constraint was because the deterministic, no other option constraint was difficult to reason about, regardless of stability. This finding went against our hypothesis that deterministic constraints should be *obvious* to children, with the initial idea being that children should recognize that they have no information about the second option that was completely absent when the actor made their choice. We consider several explanations for why children instead *struggled* to make the correct inference in this condition. First, to be coded as making the correct inference, children needed to mention the *absence* of a second option (as opposed to the presence of a tall shelf), which may have been challenging to articulate. However, the pattern of results was similar even when examining the preference inference alone, without the justification included in the measure (see Supplemental Materials). This suggests that deterministic constraints may be generally more challenging to consider. That is, without any invitation to consider an alternative choice, children may fixate on the one present option and reason that people prefer what they currently have.

In addition to the detrimental effects of stable constraints, we found that variable constraints (i.e., Not Stable condition) enhance children's constraint sensitivity, and that this enhancement effect is not

moderated by constraint type. We propose that children in the Not Stable condition may have had a different counterfactual in mind: the greater choice that the *environment* could have provided rather than the additional effort that the *agent* could have exerted. In this way, the environmental constraint may have been perceived as having a greater causal role in the agent's choice. This result and interpretation are supported by prior research findings indicating that reasoners are more likely to attribute outcomes to causal factors that are more variable (Cheng & Novick, 1991; Hilton & Slugoski, 1986; Kirfel & Lagnado, 2021).

We note two additional features of the Not Stable condition that may have enhanced children's sensitivity to constraints. First, in addition to observing contexts with fewer constraints, children also observed an agent *choosing* a toy which likely emphasized the unconstrained nature of the environment. An interesting future direction would be to test whether simply observing contexts with greater availability of options and the *potential* for choice with no agent present increases children's sensitivity to later constraints. Second, the constraint information presented on each trial of the Hard to Reach (probabilistic) constraint version (i.e., pointing out there is a shorter *and* taller shelf) may have led children to reason pragmatically that something will eventually appear on the taller shelf. In turn, children may have been especially attentive to constraints by the third trial. While this cannot explain the boost that we see for the No Other Option (deterministic constraint) version, this account suggests another interesting way to support children's constraint sensitivity—that is, alerting children that constraints in the environment may eventually change in some meaningful way.

We designed the present study to provide information about how children reason about constraints that share certain characteristics with constraints in the social world. We found that even older children were likely to neglect constraints in the stable, hard to access (probabilistic) condition. Considering that real-world constraints tend to have these two characteristics—they are stable and have probabilistic effects—our results may shine new light on why people often fail to consider constraints in their explanations of societal outcomes (Salomon & Cimpian, 2014; Sutherland & Cimpian, 2019). Future research would benefit from looking at social constraints, such as how children reason about explicit gender and racial discrimination as constraints on choice (e.g., a child choosing to join a writing club instead of the STEM club because they are being bullied by STEM club members). Our results suggest that if these social constraints are *stable* features of the environment, and children reason that the actor could still have chosen otherwise (e.g., joined the STEM club if they *really* liked the topic), children may be at risk of making unwarranted preference inferences.

Learning about others from the observable choices they make requires children to consider their constraints. The current findings suggest that, rather than representing an early-developing, robust, universal tendency, consideration of constraints in childhood depends both on the stability of constraints and the constraint type. Future research would benefit from further investigating when constraints are and are not salient to children and the consequences this may have for the inferences they make about the social world.

ACKNOWLEDGMENTS

The research and writing of this article were supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award #F32HD098777 and the National Science Foundation Awards #2203810 and #2317714 awarded to Jamie Amemiya.

CONFLICT OF INTEREST STATEMENT

No conflict of Interest to declare.

DATA AVAILABILITY STATEMENT

Data, code, and study materials are openly available at: https://osf.io/wc6av

ORCID

Jamie Amemiya https://orcid.org/0000-0001-6946-4717
Gail D. Heyman https://orcid.org/0000-0001-7764-3205
Caren M. Walker https://orcid.org/0000-0001-6532-8611

REFERENCES

Amemiya, J., Heyman, G. D., & Walker, C. M. (2023). Emphasizing others' persistence can promote unwarranted social inferences in children and adults. *Journal of Experimental Psychology: General*, *152*(10), 2977–2988. https://doi.org/10.1037/xge0001428

Amemiya, J., Mortenson, E., Ahn, S., Walker, C. M., & Heyman, G. D. (2021). Children acknowledge physical constraints less when actors behave stereotypically: Gender stereotypes as a case study. *Child Development*, *93*(1), 72–83. https://doi.org/10.1111/cdev.13643

Amemiya, J., Mortenson, E., Heyman, G. D., & Walker, C. (2023). Thinking structurally: A cognitive framework for understanding how people attribute inequality to structural causes. *Perspectives on Psychological Science*, *18*(2), 259–274. https://doi.org/10.31234/osf.io/47wr6

Baharloo, R., Vasil, N., Ellwood-Lowe, M. E., & Srinivasan, M. (2023). Children's use of pragmatic inference to learn about the social world. *Developmental Science*, *26*(3), e13333. https://doi.org/10.1111/desc.13333

Browman, A. S., Destin, M., Kearney, M. S., & Levine, P. B. (2019). How economic inequality shapes mobility expectations and behaviour in disadvantaged youth. *Nature Human Behaviour*, *3*(3), 214–220. https://doi.org/10.1038/s41562-018-0523-0

Cheng, P. W., & Novick, L. R. (1991). Causes versus enabling conditions. *Cognition*, *40*(1–2), 83–120. https://doi.org/10.1016/0010-0277(91)90047-8

Cimpian, A., & Salomon, E. (2014). The inherence heuristic: An intuitive means of making sense of the world, and a potential precursor to psychological essentialism. *Behavioral and Brain Sciences*, *37*(5), 461–480. https://doi.org/10.1017/S0140525X13002197

Eason, A. E., Doctor, D., Chang, E., Kushnir, T., & Sommerville, J. A. (2018). The choice is yours: Infants' expectations about an agent's future behavior based on taking and receiving actions. *Developmental Psychology*, *54*(5), 829–841. https://doi.org/10.1037/dev0000482

Garvin, L. E., & Woodward, A. L. (2015). Verbal framing of statistical evidence drives children's preference inferences. *Cognition*, *138*, 35–48. https://doi.org/10.1016/j.cognition.2015.01.011

Goddu, M. K., & Gopnik, A. (2020). Learning what to change: Young children use "difference-making" to identify causally relevant vari-

ables. *Developmental Psychology*, *56*(2), 275–284. https://doi.org/10.1037/dev0000872

Gweon, H., & Asaba, M. (2018). Order matters: Children's evaluation of underinformative teachers depends on context. *Child Development*, *89*(3), e278–e292. https://doi.org/10.1111/cdev.12825

Hilton, D. J., & Slugoski, B. R. (1986). Knowledge-based causal attribution: The abnormal conditions focus model. *Psychological Review*, *93*(1), 75–88. https://doi.org/10.1037/0033-295X.93.1.75

Horne, Z., Muradoglu, M., & Cimpian, A. (2019). Explanation as a cognitive process. *Trends in Cognitive Sciences*, *1*, 272–310. https://doi.org/10.1016/j.tics.2018.12.004

Hussak, L. J., & Cimpian, A. (2015). An early-emerging explanatory heuristic promotes support for the status quo. *Journal of Personality and Social Psychology*, *109*(5), 739–752. https://doi.org/10.1037/pspa0000033

Jara-Ettinger, J., Gweon, H., Schulz, L. E., & Tenenbaum, J. B. (2016). The naïve utility calculus: Computational principles underlying commonsense psychology. *Trends in Cognitive Sciences*, *20*(8), 589–604. https://doi.org/10.1016/j.tics.2016.05.011

Jara-Ettinger, J., Gweon, H., Tenenbaum, J. B., & Schulz, L. E. (2015). Children's understanding of the costs and rewards underlying rational action. *Cognition*, *140*, 14–23. https://doi.org/10.1016/j.cognition.2015.03.006

Kirfel, L., & Lagnado, D. (2021). Causal judgments about atypical actions are influenced by agents' epistemic states. *Cognition*, *212*, 104721. https://doi.org/10.1016/j.cognition.2021.104721

Kushnir, T., Xu, F., & Wellman, H. M. (2010). Young children use statistical sampling to infer the preferences of other people. *Psychological Science*, *21*(8), 1134–1140. https://doi.org/10.1177/0956797610376652

Moty, K., & Rhodes, M. (2021). The Unintended consequences of the things we say: What generic statements communicate to children about unmentioned categories. *Psychological Science*, *32*(2), 189–203. https://doi.org/10.1177/0956797620953132

Namy, L. L., & Clepper, L. E. (2010). The differing roles of comparison and contrast in children's categorization. *Journal of Experimental Child Psychology*, *107*(3), 291–305. https://doi.org/10.1016/j.jecp.2010.05.013

Peretz-Lange, R., Perry, J., & Muentener, P. (2021). Developmental shifts toward structural explanations and interventions for social status disparities. *Cognitive Development*, *58*, 101042. https://doi.org/10.1016/j.cogdev.2021.101042

Pesowski, M. L., Denison, S., & Friedman, O. (2016). Young children infer preferences from a single action, but not if it is constrained. *Cognition*, *155*, 168–175. https://doi.org/10.1016/j.cognition.2016.07.004

Rhodes, M., & Mandalaywala, T. M. (2017). The development and developmental consequences of social essentialism: Social essentialism. *Wiley Interdisciplinary Reviews: Cognitive Science*, *8*(4), e1437. https://doi.org/10.1002/wcs.1437

Salomon, E., & Cimpian, A. (2014). The inherence heuristic as a source of essentialist thought. *Personality and Social Psychology Bulletin*, *40*(10), 1297–1315. https://doi.org/10.1177/0146167214541659

Skordos, D., & Papafragou, A. (2016). Children's derivation of scalar implicatures: Alternatives and relevance. *Cognition*, *153*, 6–18. https://doi.org/10.1016/j.cognition.2016.04.006

Sutherland, S. L., & Cimpian, A. (2019). Developmental evidence for a link between the inherence bias in explanation and psychological essentialism. *Journal of Experimental Child Psychology*, *177*, 265–281. https://doi.org/10.1016/j.jecp.2018.06.002

Vanderbilt, K. E., Heyman, G. D., & Liu, D. (2014). In the absence of conflicting testimony young children trust inaccurate informants. *Developmental Science*, *17*(3), 443–451. https://doi.org/10.1111/desc.12134

Vasilyeva, N., Gopnik, A., & Lombrozo, T. (2018). The development of structural thinking about social categories. *Developmental Psychology*, *54*(9), 1735–1744. https://doi.org/10.1037/dev0000555

Wong, A., Cordes, S., Harris, P. L., & Chernyak, N. (2023). Being nice by choice: The effect of counterfactual reasoning on children's social evaluations. *Developmental Science*, e13394. https://doi.org/10.1111/desc.13394

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Amemiya, J., Heyman, G. D., & Walker, C. M. (2024). How barriers become invisible: Children are less sensitive to constraints that are stable over time. *Developmental Science*, e13496. https://doi.org/10.1111/desc.13496

Appendix 1

No Other Option Constraint Scenarios

[scenario 1]

Here is a girl named Bailey and today is her first day at school. At Bailey's school there is a toy shelf with **[a boat and a plane on it/a boat on it]**. Can you remind me, what is on the toy shelf?

> [if correct] That's right! There is a **[boat and a plane/boat]** on the toy shelf.
>
> [if incorrect] Remember, there is a **[boat and a plane/boat]** on the toy shelf.

For the first activity of the day, the teacher tells Bailey that she *has* to pick *one* toy. First Bailey sees the boat. **[Then Bailey sees the plane./(no other sentence)]** Then, Bailey takes the boat. Now I have a question for you. Do you think that Bailey likes the boat *more* than **[the/this]** plane (for constrained choice, plane pops up on the righthand side of the screen)? Why is that?

[scenario 2]

Here is a girl named Sam and today is *her* first day at school (a different-colored school is shown). At Sam's school there is a toy shelf with **[a basketball and a baseball on it/a basketball on it]**. Can you remind me, what is on the toy shelf?

> [if correct] That's right! There is a **[basketball and a baseball/basketball]** on the toy shelf.
>
> [if incorrect] Remember, there is a **[basketball and a baseball/basketball]** on the toy shelf.

For the first activity of the day, the teacher tells Sam that she *has* to pick *one* toy. **[First/(nothing)]** Sam sees the basketball. **[Then Sam sees the basketball./(no other sentence)]** Then, Sam takes the basketball. Now I have a question for you. Do you think that Sam likes the basketball *more*

than **[the/this]** baseball (for constrained choice, baseball pops up on the righthand side of the screen)? Why is that?

[test scenario]

Here is a girl named Cody and today is *her* first day at school (a different-colored school is shown). At Cody's school there is a toy shelf with a circle toy on it. Can you remind me, what is on the toy shelf?

[if correct] That's right! There is a circle toy on the toy shelf.

[if incorrect] Remember, there is a circle toy on the toy shelf.

For the first activity of the day, the teacher tells Cody that she *has* to pick *one* toy. Cody sees the circle toy. Then, Cody takes the circle toy. Now I have a question for you. Do you think that Cody likes the circle toy *more* than this triangle toy (triangle toy pops up on the righthand side of the screen)? Why is that?