DOI: 10.1111/cdev.13643

EMPIRICAL ARTICLE

CHILD DEVELOPMENT

Children acknowledge physical constraints less when actors behave stereotypically: Gender stereotypes as a case study

Jamie Amemiya[1] | **Elizabeth Mortenson**[2] | **Sohee Ahn**[1] | **Caren M. Walker**[1] | **Gail D. Heyman**[1]

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

[2]Department of Psychology, Stanford University, Stanford, California, USA

Correspondence
Jamie Amemiya, Department of Psychology, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0109, USA.
Email: jamemiya@ucsd.edu

Funding information
Eunice Kennedy Shriver National Institute of Child Health and Human Development, Grant/Award Number: F32HD098777

Abstract

A fundamental part of understanding structural inequality is recognizing that constrained choices, particularly those that align with societal stereotypes, are poor indicators of a person's desires. This study examined whether children (N = 246 U.S. children, 53% female; 61% White, 24% Latinx; 5–10 years) acknowledge constraints in this way when reasoning about gender-stereotypical choices, relative to gender-neutral and gender-counterstereotypical choices. Results indicated that children more frequently inferred preferences regardless of whether the actor was constrained when reasoning about gender-stereotypical choices, as compared to gender-neutral or gender-counterstereotypical choices. We also found evidence of an age-related increase in the general tendency to acknowledge constraints. We discuss the broader implications of these results for children's understanding of constraints within society.

There is an increasing interest in how children understand structural inequality, which is inequality that is caused by environmental constraints within a society (Bonilla-Silva, 1997; Haslanger, 2016; Roberts & Rizzo, 2020; Ruck et al., 2019). Indeed, children's understanding of structural inequality has implications for how they reason about the causes of societal disparities and for their motivation to address them (Elenbaas et al., 2020; Mistry et al., 2012; Rizzo et al., 2018; Vasilyeva et al., 2018). One particularly important case is children's understanding of gender inequalities, as essentialist reasoning and stereotypes about gender are early emerging and especially robust across development (Bian et al., 2017; Martin et al., 1990; Rhodes & Mandalaywala, 2017).

To understand structural inequality, children must consider how environmental constraints may have contributed to the outcomes they observe. A fundamental part of this understanding is recognizing that *constrained choices*—that is, choices made from limited options—are poor indicators of others' desires (Bonilla-Silva, 1997; Hetey & Eberhardt, 2018; Stephens et al., 2009). Indeed, compared to unconstrained actions, constrained actions provide relatively ambiguous evidence for a person's preference, as it is less clear whether the choice was made because of an intrinsic desire for that option or because that was the option more readily available.

Understanding of constraints begins early in life, with some aspects of constraint understanding emerging in infancy (Gergely & Csibra, 2003; Koenig et al., 2019; Kushnir, 2018; Liu et al., 2017, 2019; Woodward, 2009). In the classic infant paradigm, infants observe a human agent repeatedly grasping one of two objects that are both within reach (Woodward, 1998). In this case, infants infer that the agent prefers the selected object (Woodward, 1998, 1999), but critically, they are *less* likely to make this inference if the agent is constrained in some way (e.g., if she cannot see the other option; Luo & Baillargeon, 2007). By 5–6 years of age, children are able to make such rational inferences about constrained and unconstrained choices even when observing a single action (Pesowski et al., 2016).

However, when reasoning about choices that are relevant for understanding social group differences, such as gender differences in play behavior, children face a unique challenge: Constrained choices of this kind are often confounded with children's stereotype knowledge about what the agent's *group* typically likes. Consider a child reasoning about a girl who plays with a doll, but the doll was the *only* option that was available to her. Children may recognize the constraint (i.e., there were no other options available) and view this action to be relatively ambiguous with respect to the girl's actual preferences (Jara-Ettinger et al., 2015; Kushnir et al., 2010). However, given children's robust stereotype knowledge that girls, in general, like dolls (Bigler & Liben, 2007), and given that the girl took the toy as opposed to not taking it at all, children may ultimately conclude that *this* girl prefers the doll, despite her constraints. In this study, we examined if children are more likely to infer that constrained choices are informative of an agent's desires when the action aligns with widely known gender stereotypes.

Prior research suggests that children are not especially attuned to environmental influences on stereotypical behavior, suggesting that they may view constrained stereotypical choices as informative. Indeed, children tend to neglect environmental factors when reasoning about well-known social group differences, despite the role that environmental influences have in producing such variance (Cimpian & Salomon, 2014; Rhodes & Mandalaywala, 2017).

With respect to *why* environmental constraints are not usually considered, researchers have theorized that children may not be aware of constraints or that they may not readily come to mind (Cimpian & Salomon, 2014; Horne et al., 2019). In this study, however, we make the constraint explicit by showing a physical obstacle, which is a highly salient type of constraint for children (Chernyak et al., 2013; Pesowski et al., 2016). Thus, if children infer a preference from a physically constrained stereotypical choice, it is likely because stereotype knowledge may lead children to *override* constraint information and view such choices as diagnostic. Although drawing on prior knowledge is part of rational inference (Gopnik & Wellman, 2012; Perfors et al., 2011), here, it may lead children to make false conclusions about others' desires. Critically, if children infer preferences from constrained choices repeatedly over time, they may develop inaccurate causal explanations for social group differences and inequalities. For example, children may use their observations of constrained choices as (seemingly) good evidence that gender differences in play behavior are caused by inherent differences in preferences.

In addition to comparing children's reasoning about stereotypical choices (e.g., a girl chooses a doll over a truck) to gender-neutral choices (e.g., a girl chooses a yellow over a green toy), we also examined their reasoning about *counterstereotypical* choices (e.g., a girl chooses a truck over a doll). We included this additional condition for two reasons. First, by varying the character's *choice* within the same set of toys, we were able to rule out an account in which children ignore characters' choices and exclusively demonstrate their stereotype knowledge at test. Second, given that counterstereotypical choices strongly violate prior knowledge, children may be more likely to acknowledge constraints in these contexts. Indeed, research has shown that children refrain from inferring preferences when choices violate assumptions—for example, when an actor chooses a less attractive toy (Pesowski et al., 2016). If children are *less* likely to override constraint information when actors make counterstereotypical choices, this would provide empirical support for both ideas.

Finally, we examined developmental trends in reasoning about constraints by including two age groups (5- to 6-year-old and 9- to 10-year-old U.S. children). Previous research points to two distinct possibilities for children growing up in Western cultures. One possibility is that as children grow older, their greater cognitive capacities allow them to factor environmental constraints into their inferences about the world (Cimpian & Salomon, 2014; Cimpian & Steinberg, 2014; Pesowski et al., 2016). In contrast, other work suggests that greater exposure to cultures that emphasize personal autonomy may *decrease* children's sensitivity to certain types of constraints over the course of development (Chernyak et al., 2013, 2019; Kushnir et al., 2015; Seiver et al., 2013; Wente et al., 2016). For example, older U.S. children are less sensitive to information that supports situational explanations of social behavior than younger U.S. children (Gopnik et al., 2017; Seiver et al., 2013), and older U.S. children are less likely to view social obligations as constraints compared to their same-aged counterparts from other cultures (e.g., from Nepal; Chernyak et al., 2013).

The present study

Our main research aim was to examine whether children were more likely to override constraint information when actors make stereotypical choices, compared to neutral or counterstereotypical choices. As a first test of this hypothesis, we pit a constraint that is known to be highly salient to children, physical constraints (Chernyak et al., 2013; Pesowski et al., 2016), against gendered toy stereotypes, which are early emerging and especially robust in childhood (Bigler & Liben, 2007; Martin et al., 1990). While informed by prior theory, this analysis was largely exploratory in nature.

Adapting a paradigm from prior research (Jara-Ettinger et al., 2015; Pesowski et al., 2016), children observed either stereotypical choices (e.g., a girl chooses a doll over a truck), neutral choices (e.g., a girl chooses a yellow robot over a green robot), or counterstereotypical choices (e.g., a girl chooses a truck over a doll), as shown

in Figure 1. Physical constraints were manipulated within subjects; in the *no constraint* scenario, the character could reach both toys, whereas in the *constraint* scenario, the character could only reach the chosen toy. We predicted that children would override constraint information more often in the *stereotypical* condition compared to the *neutral* and *counterstereotypical* conditions. That is, we hypothesized that children would be more likely to make strong preference inferences, regardless of the actor's constraints, when reasoning about stereotypical choices. Given the mixed findings regarding the developmental trajectory of children's reasoning about constraints, we did not have specific predictions regarding age differences.

METHOD

Participants

Participants were a total of 246 children (53% female; 61% White, 24% Latinx, 10% Asian, 3% mixed race/ethnicity, 1% Black) ages 5–6 years (n = 125; M = 6.02 years) and 9–10 years (n = 121; M = 9.83 years) recruited in 2019 from museums and schools in the southern California area of the United States that were in close proximity to the associated university. An additional 13 children were excluded due to comprehension check failures (n = 4), other comprehension issues that were noted at the time of data collection (n = 2), not responding to all inference questions (n = 2), parent interference (n = 3), and experimenter error (n = 2). All procedures were approved by the Institutional Review Board at the associated university and informed consent was obtained for all participants.

Procedure and measures

Children were tested in museums and schools by an experimenter who narrated an animated presentation on a laptop. Participants were assigned, between subjects, to either the *stereotypical*, *neutral*, or *counterstereotypical* toy choice condition. Children in all conditions reasoned about an unconstrained *and* a constrained choice (i.e., constraints were manipulated within-subjects). In particular, each child observed two scenarios: (1) a character who chose a toy in an environment with *no constraint*, in which the character could reach both toys, and (2) a character who chose a toy in an environment with a physical *constraint*, in which the character could only reach one of the two toys. We were interested in the extent to which children would show sensitivity to constraint information by *reducing* the strength of their preference inferences when reasoning about the constraint scenario compared to the no constraint scenario. The order in which the two scenarios were presented was counterbalanced and children were randomly assigned to observe either two female or two male characters.

Prior to observing the two scenarios, there was a training period to ensure that children understood that

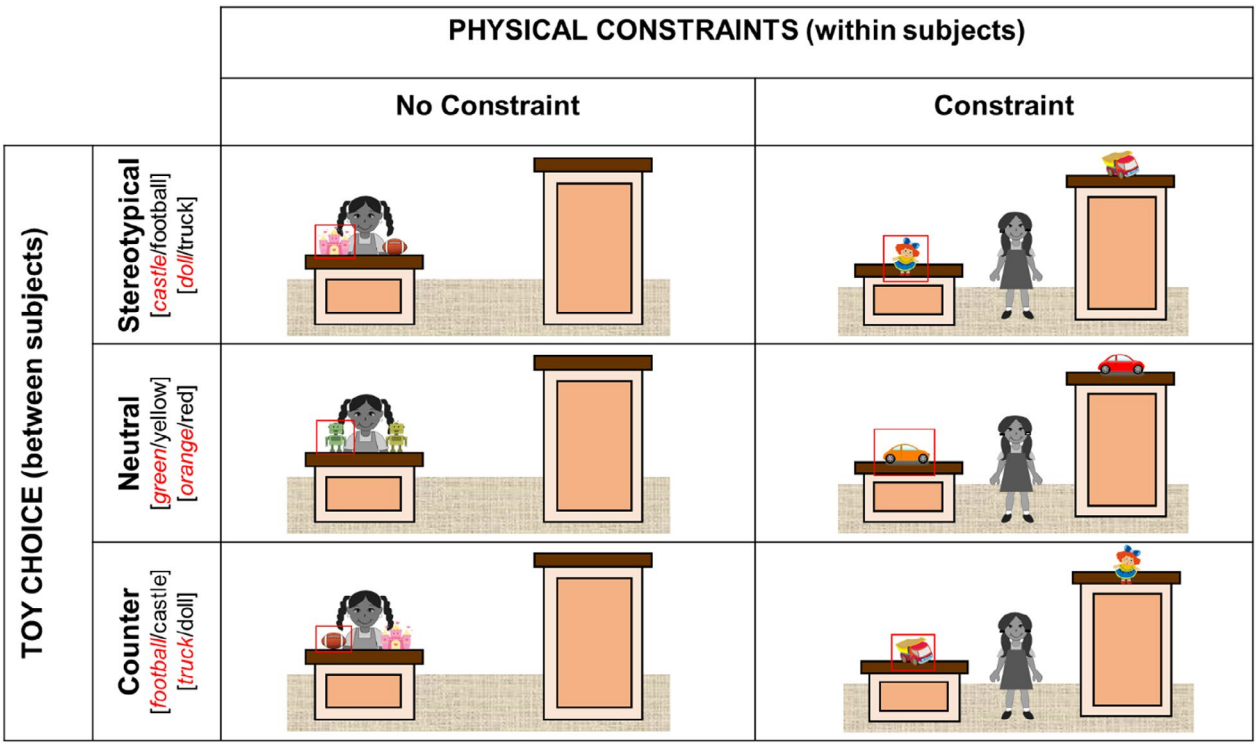

FIGURE 1 Study design with female characters; the male version used the same set of toys

the character could reach a toy if it was on the shorter shelf, but not the taller shelf (n = 4 children failed this comprehension check and were excluded from analyses). A teddy bear toy was used in the training for all conditions. The following are examples of the training period, the no constraint scenario, and the constraint scenario from the *stereotypical*, *female characters* condition. The key constraint manipulation is bolded:

> *constraint training and comprehension check*
>
> [training] Here is a playroom with two countertops. One shorter one and one taller one. Here is a girl, and she wants to play with a teddy bear. When the teddy bear is on the shorter one, she can reach it and gets it. When the teddy bear is on the taller one, she cannot reach it and does not get it. [comprehension check] Can you point to the one that the girl wants the teddy bear to be on? (correct answer = shorter one)
>
> *no constraint scenario*
>
> This girl also wants to play with a toy in the playroom. First, the girl sees this castle. This castle is on the shorter one and she can reach it. Then the girl sees this football. This football is **also on the shorter one and she can reach it**. Then the girl gets the castle.
>
> *constraint scenario*
>
> This girl also wants to play with a toy in the playroom. First, the girl sees this doll. This doll is on the shorter one and she can reach it. Then the girl sees this truck. This truck is **way up on the taller one and she cannot reach it**. Then the girl gets the doll.

Dependent measures

After each scenario (see again Figure 1), both toys in the respective scene appeared on the screen. The experimenter asked the child, "Can you point to the one the girl likes more (chosen toy [i.e., castle] or unchosen toy [i.e., football])?" Next, one smaller and one larger "thumbs-up" image appeared on the screen, and the experimenter said, "Sometimes we're kind of sure and sometimes we're really sure. Are you kind of sure (experimenter points to little thumbs up) or really sure (experimenter points to large thumbs up) that she likes that one more?" These responses were combined into one score for each scenario, referred to as the immediate *preference inference*, such that higher scores indicated greater certainty that the character preferred the chosen toy over the unchosen toy, with specific scores being 4 = *chosen toy, really sure*, 3 = *chosen toy, kind of sure*, 2 = *unchosen toy, kind of sure*, 1 = *unchosen toy, really sure*.

After the preference inference questions, children made a *stability inference* for each scenario, such that they were asked to reason about which toy the character would choose the following day when presented with new, but thematically similar types of toys (see Figure 2 for the accompanying images). Specifically, the experimenter said (in the *stereotypical, female character* condition), "The next day there is a new princess toy and a new soccer ball on the shorter one. The girl sees both new toys. Which one will she choose?" Children were then similarly asked to rate whether they were "kind of sure" or "really sure." Responses were coded the same way, such that higher scores indicated greater certainty that the character would choose the same type of toy over the other type of toy: 4 = *same as previously chosen toy*, *really sure*, 3 = *same as previously chosen toy*, *kind of sure*, 2 = *same as previously unchosen toy*, *kind of sure*, 1 = *same as previously unchosen toy*, *really sure*.

In total, each child had four inference scores: two immediate *preference inference* scores (one for the *no constraint* scenario, one for the *constraint* scenario) and two *stability inference* scores (one for the *no constraint* scenario, one for the *constraint* scenario).

Profile coding

To characterize children's patterns of reasoning across the *no constraint* and *constraint* scenarios (recall that each child reasoned about both types of situations), we classified children's *preference inference* scores and children's *stability inference* scores into response profiles, respectively. For complete descriptions of these profiles, see Table 1. We were primarily interested in two profiles: children in the *overrode constraint* profile and children in the *acknowledged constraint* profile.

Children were classified in the *overrode constraint* profile if, across both the no constraint and constraint scenarios, they said that they were "really sure" that the character liked the chosen toy (for the preference inference) or would continue to choose the same kind of toy (for the stability inference). In other words, children in the *overrode constraint* profile always made the strongest preference inference regardless of the character's constraints. We expected that children would be most likely to be in this profile in the *stereotypical* condition.

Children were classified in the *acknowledged constraint* profile if their constraint score was lower than their no constraint score. This pattern of scores indicated that children expressed less certainty about the character's preferences when constrained than unconstrained. The logic of this profile aligns with prior studies that examine whether children are more likely to refrain from inferring a preference in constrained compared to unconstrained situations (Jara-Ettinger et al., 2015;

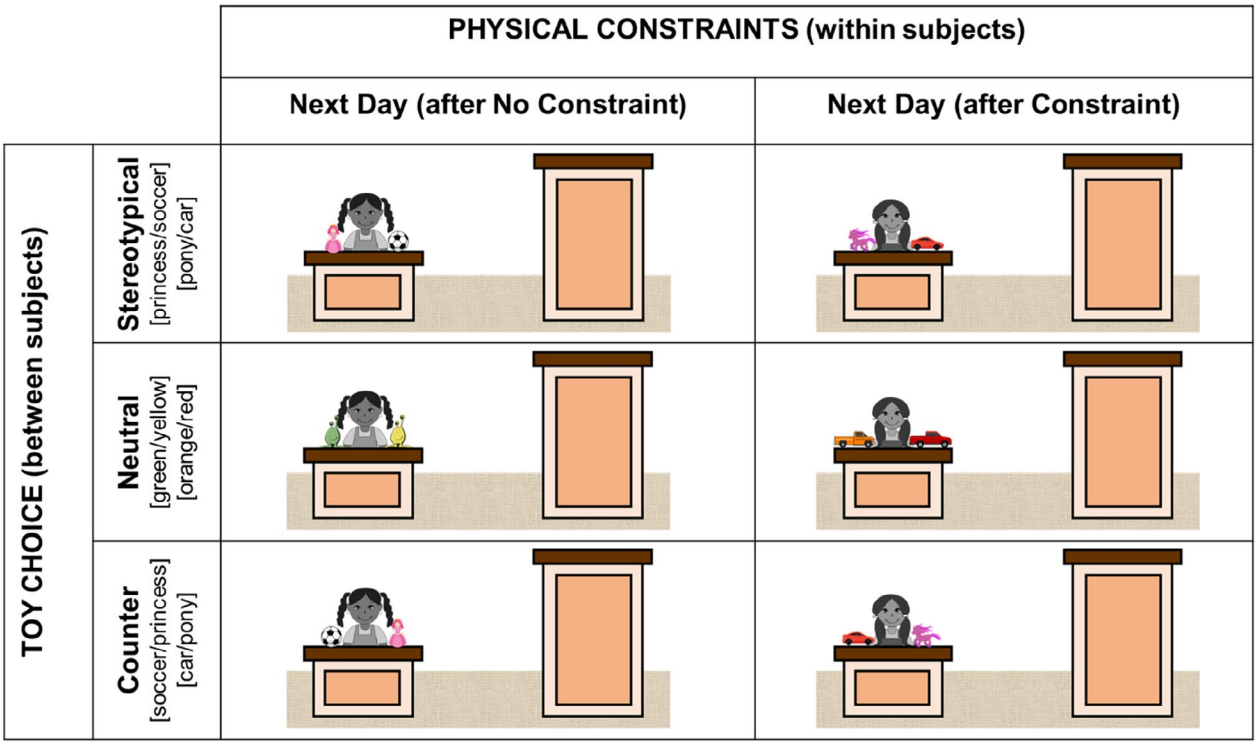

FIGURE 2 "Next-day" scenarios for stability inference with female characters; the male version used the same set of toys

Kushnir et al., 2010). Our hypothesis was that children would be the least likely to be classified in this profile in the *stereotypical* condition.

Though not of central interest, three other reasoning profiles emerged that we report. There were children classified in the *overrode constraint and choice* profile, in which they expressed that they were "really sure" that the characters preferred the *unchosen* toys across both scenarios. This profile indicated that children completely disregarded the choices that they observed and instead privileged their own beliefs about the actor. In addition, some children made the *reverse inference* in which they were more certain the character prefers the chosen toy in the constraint scenario than in the no constraint scenario. We referred to this profile as "reverse" because it went in the opposite direction of what is considered to be rational inference about constraints (Gergely & Csibra, 2003). Finally, some children were classified as *ambivalent*. These children selected the same toy across scenarios (i.e., the chosen toy or unchosen toy both times) but always said that they were only "kind of sure."

Open-ended responses

After each judgment, children were asked to justify their answer with the question, "Why is that?" We focused specifically on children's explanations for their preference judgment during the *constraint* trial, as children's reasoning about this trial was most relevant to profile membership. These explanations were coded for three themes. The first was *stereotypes*, which included gender-stereotypical statements such as, "Girls like dolls," or a formal explanation that refers to the gender of the character, for example, "Because she's a girl" (Cohen's $\kappa = .91$; 15% of explanations).

Children's explanations were also coded for mentioning the physical constraint. Notably, we found that children described the constraint in two distinct ways. First, some children discussed the constraint in the expected negative way, in which they focused on the character's inability to get the toy on the taller shelf. We called this type of explanation *constraint negative* (e.g., "He can't reach the red car"; "He could've liked the other one but he couldn't reach it"; Cohen's $\kappa = .90$; 22% of explanations). Second, some children unexpectedly discussed the constraint in a *positive* way, such that they reasoned that the toy on the shorter shelf was an *accessible* option. We called this type of explanation *constraint positive* (e.g., "Because he is able to pick up that one"; "The football is reachable; he can play with his friends"; Cohen's $\kappa = .86$; 13% of explanations). Disagreements between coders were resolved via discussion.

RESULTS

Figures 3 and 4 present the profiles by toy choice condition and age group (raw scores and means are reported in Supporting Information). As reported in Tables 1

TABLE 1 Profile coding

Profile name (same for preference and stability DVs)[a]	Definition—preference DV	Definition—stability DV	Corresponding scores[b]
Overrode constraint	Child is "really sure" that the character likes the *chosen* toy in both the no constraint and constraint situations	Child is "really sure" that the character will choose the same kind of toy as the previously *chosen* toy in both the no constraint and constraint situations	No constraint = 4 and constraint = 4
Acknowledged constraint	Child is relatively less certain that the character likes the *chosen* toy in the constraint situation than no constraint situation	Child is relatively less certain that the character will choose the same kind of toy as the previously *chosen* toy in the constraint situation than no constraint situation	Constraint score < no constraint score
Overrode constraint and choice	Child is "really sure" that the character likes the *unchosen* toy in both the no constraint and constraint situations	Child is "really sure" that the character will choose the same kind of toy as the previously *unchosen* toy in both the no constraint and constraint situations	No constraint = 1 and constraint = 1
Reverse inference	Child is relatively more certain that the character likes the *chosen* toy in the constraint situation than no constraint situation	Child is relatively more certain that the character will choose the same kind of toy as the previously *chosen* toy in the constraint situation than no constraint situation	Constraint score > no constraint score
Ambivalent	Child is "kind of sure" that the character likes either the *chosen* or *unchosen* toy in both the no constraint and constraint situations	Child is "kind of sure" that the character will choose the same kind of toy as the previously *chosen* or *unchosen* toy in both the no constraint and constraint situations	No constraint = 3 and constraint = 3 or no constraint = 2 and constraint = 2

[a]Preference inference and stability inference profiles were separate dependent variables (DVs).

[b]Children's ratings were coded such that higher scores indicate greater certainty that the character likes the chosen toy (preference inference) or will continue to choose the same kind of toy as the chosen toy (stability inference), with specific scores being 4 = *chosen toy*, *really sure*; 3 = *chosen toy*, *kind of sure*; 2 = *unchosen toy*, *kind of sure*; 1 = *unchosen toy*, *really sure*.

and 2, we conducted logistic regression models that predicted membership to the key profiles of interest: *overrode constraint* (vs. all other profiles) and *acknowledged constraint* (vs. all other profiles). In these models, we included the main effects of toy choice condition (with the *stereotypical condition* as the reference group), age group (*older children* = 0.5, *younger children* = −0.5), order of scenarios (*no constraint scenario first* = 0.5, *constraint scenario first* = −0.5), and character gender (*female characters* = 0.5, *male characters* = −0.5). We also tested for interaction effects between study condition and age group and found no significant interaction effects, and thus focus on main effects.

The results in Table 2 reveal a clear pattern: Across both dependent measures (preference and stability inferences), children were significantly less likely to be in the *overrode constraint* profile in the *neutral* condition (preference: $B = -0.96$, $p < .01$; stability: $B = -2.77$, $p < .001$) and *counterstereotypical* condition (preference: $B = -1.59$, $p < .001$; stability: $B = -2.39$, $p < .001$) relative to the *stereotypical* condition. Table 3 reports a similar pattern for the *acknowledged constraint* profile in three of the four comparisons: Children were significantly more likely to be in the *acknowledged constraint* profile in the *neutral* condition (for the stability inference; stability: $B = 1.09$, $p < .01$) and *counterstereotypical* condition (for both inferences; preference: $B = 0.74$, $p < .05$; stability: $B = 0.80$, $p < .05$) compared to the *stereotypical* condition. Thus, in line with our hypotheses, children were the *least* sensitive to constraints when actors made stereotypical choices. Rather, children made strong preference inferences from stereotypical choices, regardless of whether the choice was constrained or unconstrained.

While these effects were not significantly moderated by age group (i.e., the effects of stereotypes could be generalized across age groups), there was a main developmental effect on constraint reasoning. Specifically, with increasing age, children were less likely to be in the *overrode constraint* profile (preference: $B = -0.66$, $p < .05$) and more likely to be in the *acknowledged constraint*

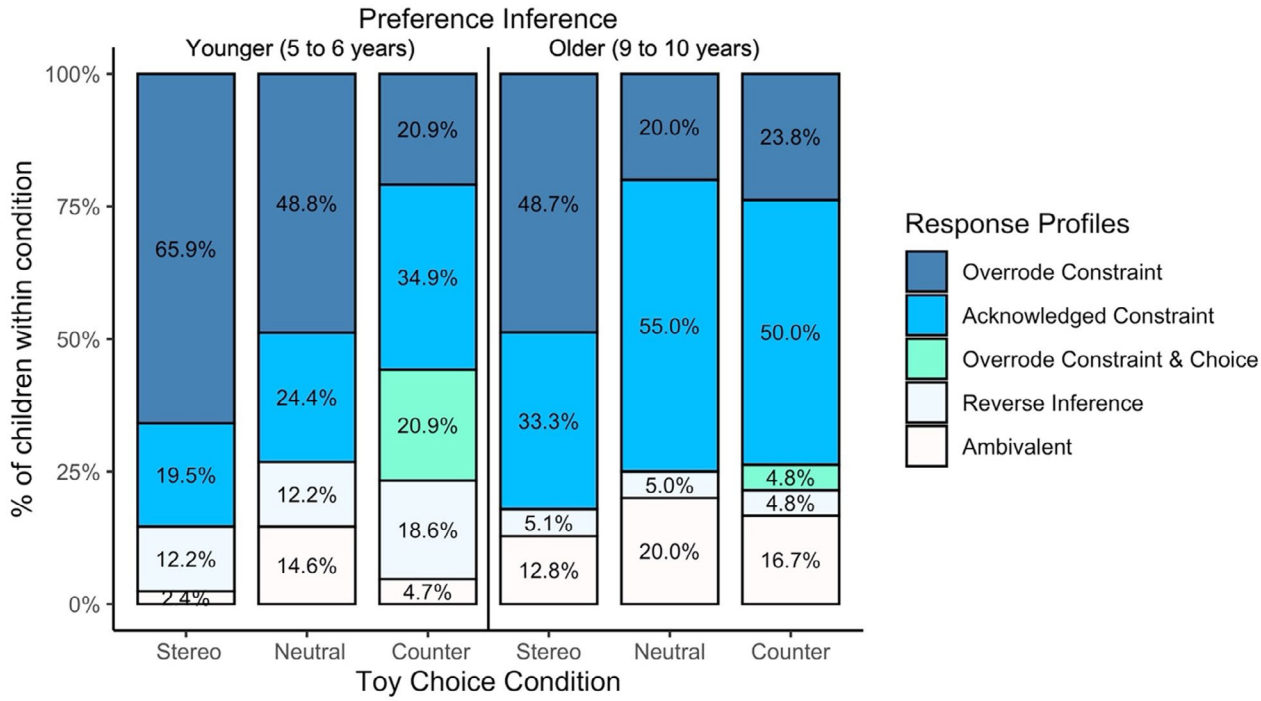

FIGURE 3 Preference inference response profiles by toy choice condition and age

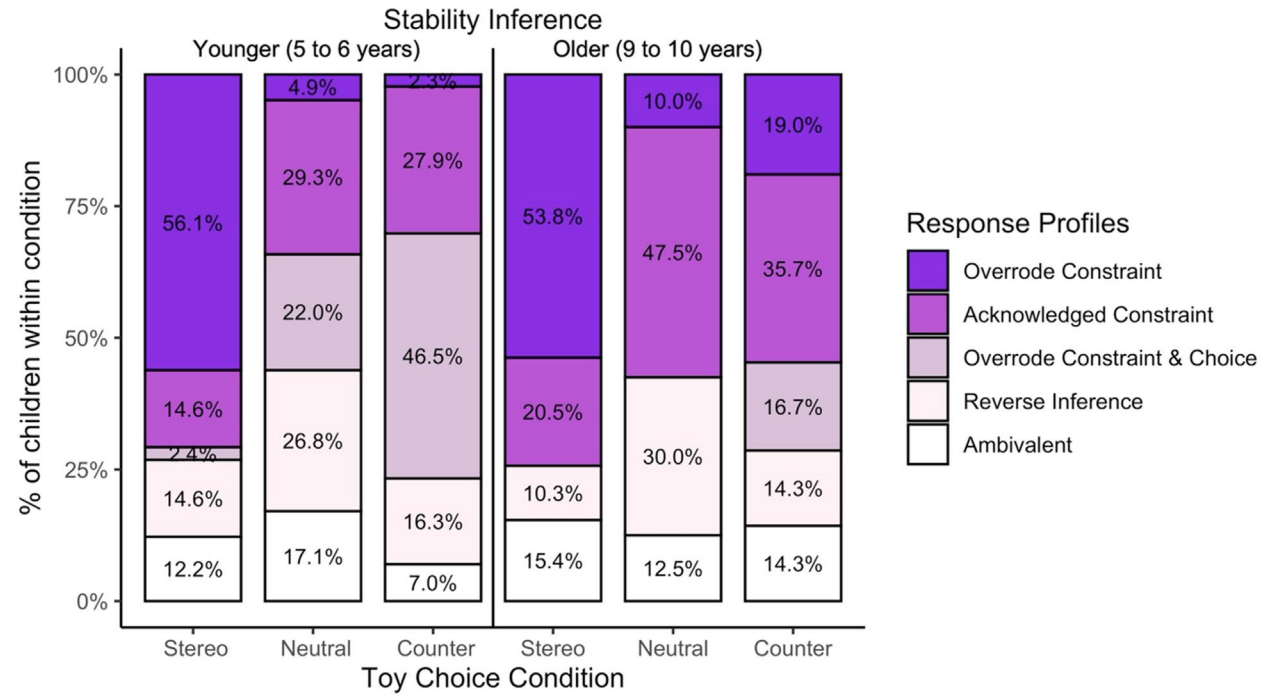

FIGURE 4 Stability inference response profiles by toy choice condition and age

profile (preference: $B = 0.90$, $p < .01$). This pattern of results suggests that older children (9–10 years) are more sensitive to constraint information relative to younger children (5–6 years).

Another notable finding was that, despite being relatively more frequent in the *neutral* and *counterstereotypical* conditions and among older children, the absolute rates of children being in the *acknowledged constraint* profile were low. The rates ranged from 13.6% to 34.9% for younger children and 20.5% to 55.0% for older children. We discuss possible reasons why in the discussion.

With respect to the other profiles that emerged, children in the *overrode constraint and choice* profile (i.e., inferring the character prefers the toys they did *not* select

TABLE 2 Predicting children's membership to overrode constraint profile

	Overrode constraint profile (vs. all other profiles)					
	Preference inference			Stability inference		
	B	*SE*	Odds ratio	*B*	*SE*	Odds ratio
Neutral (vs. stereo)	−0.96**	0.33	0.38	−2.77***	0.48	0.06
Counter (vs. stereo)	−1.59***	0.35	0.20	−2.39***	0.43	0.09
Older (vs. younger)	−0.66*	0.28	0.51	0.50	0.35	1.65
Order 1 (vs. order 2)	−0.10	0.28	0.91	−0.25	0.35	0.78
Female char (vs. male)	0.08	0.28	1.08	−0.23	0.35	0.79

*$p < .05$.; **$p < .01$.; ***$p < .001$.

TABLE 3 Predicting children's membership to acknowledged constraint profile

	Acknowledged constraint profile (vs. all other profiles)					
	Preference inference			Stability inference		
	B	*SE*	Odds ratio	*B*	*SE*	Odds ratio
Neutral (vs. stereo)	0.63†	0.35	1.87	1.09**	0.38	2.97
Counter (vs. stereo)	0.74*	0.34	2.10	0.80*	0.38	2.23
Older (vs. younger)	0.90**	0.28	2.45	0.53†	0.29	1.70
Order 1 (vs. order 2)	−0.17	0.28	0.84	0.05	0.29	1.05
Female char (vs. male)	0.14	0.28	1.15	−0.22	0.29	0.80

†$p < .10$.
*$p < .05$.; **$p < .01$.

with high certainty) were frequently in the *counterstereotypical* condition. In other words, children were most likely to disregard the evidence they observed when the choices violated gender stereotypes. Children in the *reverse inference* profile and *ambivalent* profile were more evenly distributed across conditions, suggesting that these patterns of reasoning were not tied to specific toy choices.

Explanations

Condition and age differences

As expected, there were significant differences in mentioning stereotypes by toy choice condition, $\chi^2(2) = 24.33$, $p < .001$. Children only mentioned stereotypes in the *stereotypical* condition (18% of explanations; e.g., "Girls like dolls so they like dolls") and *counterstereotypical* condition (27% of explanations; e.g., "Because girls like castles" [when the child justified why they think the girl likes the *unselected* toy]), and never in the *neutral* condition (0% of explanations). Thus, we successfully manipulated the toys to tap children's gender stereotypes.

Constraint negative explanations were relatively uncommon (e.g., "Because he cannot reach it"; 22% of explanations overall), and did not differ by condition, $\chi^2(2) = 3.81$, $p = .15$. This indicates that children were *equally* likely (albeit unfrequently) to discuss the constraint in negative ways across the three conditions.

However, there were condition differences in the *constraint positive* explanation (e.g., "Because she can reach it easier"), $\chi^2(2) = 12.76$, $p = .002$. Recall that, for this explanation, children discussed the toy on the shorter shelf being *accessible* as opposed to the toy on the taller shelf being out of reach. Interestingly, viewing constrained options in this more positive light was more common in the *stereotypical* (16% of explanations) and *neutral* (22% of explanations) conditions and less common in the *counterstereotypical* condition, in which almost no children viewed the constrained toy through this positive lens (4% of explanations). Thus, while children can be flexible in their perceived valence of constrained choices, this flexibility does not extend to counterstereotypical choices.

We also found one age effect: older children (36% of older children) were more likely than younger children (9% of younger children) to give a *constraint negative* explanation, $\chi^2(1) = 25.35$, $p < .001$, which provides further evidence of older children's sensitivity to constraint information.

Profile and explanation associations

We then examined whether children in the *overrode constraint* and the *acknowledged constraint* reasoning

profiles were more likely to give certain types of explanations. We expected that children in the *overrode constraint* profile would be less likely to discuss the constraints in negative ways while, in contrast, children in the *acknowledged constraint* profile would be more likely to mention the negative aspects of the constraint. We also expected that, for the *stereotypical* condition, mentioning gender stereotypes would be linked to greater membership in the *overrode constraint* profile and lower likelihood of being in the *acknowledged constraint* profile.

As expected, children in the *overrode constraint* profile (collapsed across toy choice conditions and age groups) were less likely to give a *constraint negative* explanation compared to other profiles (preference: $\chi^2[1] = 8.60$, $p = .003$, 12% of *overrode constraint* profile vs. 29% of all other profiles; stability: $\chi^2[1] = 2.83$, $p = .09$, 14% of *overrode constraint* profile vs. 25% of all other profiles). In other words, children who made strong preference inferences rarely discussed the toy on the taller shelf being out of reach. In contrast, children in the *acknowledged constraint* profile were more likely to give a *constraint negative* explanation (preference: $\chi^2[1] = 11.40$, $p < .001$, 35% of *acknowledged constraint* profile vs. 15% of all other profiles; stability: $\chi^2[1] = 6.20$, $p = .01$, 33% of *acknowledged constraint* profile vs. 18% of all other profiles). That is, children who acknowledged constraints were more likely to attribute their inferences to the fact that the character could not reach the toy option on the taller shelf.

Interestingly, children in the *overrode constraint* profile were *more* likely to give a *constraint positive* explanation (preference: $\chi^2[1] = 13.51$, $p < .001$, 24% of override constraint profile vs. 7% of all other profiles; stability was not significant). In particular, children who made strong preference inferences would more often talk about the *availability* of the toy on the shorter shelf (i.e., I am very sure that she likes the current toy because she can reach it). In line with this pattern, children in the *acknowledged constraint* profile were *less* likely to give a *constraint positive* explanation (preference: $\chi^2[1] = 7.79$, $p = .005$, 4% of *acknowledged constraint* profile vs. 18% of all other profiles; stability was not significant). This pattern makes sense, as children who were in the *acknowledged constraint* profile more often discussed the negative aspects of the constraint.

Finally, we examined whether response profiles in the stereotypical condition related to mentioning stereotypes. We did not find evidence for this association across any measures (mentioning stereotypes was generally low across profiles); explicitly mentioning stereotypes was not associated with the *overrode constraint* profile. Notably, however, in the *counterstereotypical* condition, children in the *overrode constraint and choice* profile were significantly more likely to mention stereotypes when justifying their inferences (preference: $\chi^2[1] = 16.14$, $p < .001$, 82% of override constraint and choice profile vs. 19% of all other profiles; stability: $\chi^2[1] = 4.84$, $p = .03$, 44% of override constraint and choice profile vs. 19% of all other profiles). That is, children who disregarded the evidence they observed (e.g., they expressed that they were really sure the girl liked the castle, despite her taking the football) often cited their stereotype knowledge to justify this inference (e.g., "Because girls like castles").

Taken together, children's reasoning profiles related to *different* ways of describing the constraint. Children in the *overrode constraint* profile focused more on the positive aspects of the constrained situation (i.e., the character having access to the chosen toy), whereas children in the *acknowledged constraint* profile focused more on the negative aspects (i.e., the character lacking access to the other toy). Stereotype explanations were generally low and only related to the *overrode constraint and choice* profile in the *counterstereotypical* condition (i.e., when they stated that the character likes the *unchosen*, stereotypical toy). One possibility is that children may find it too obvious to explicitly state their stereotype knowledge unless they are using it to justify an inference that clearly violates the evidence they are presented (Schwarz, 1994).

DISCUSSION

This study examined a fundamental aspect of understanding structural inequality: reasoning about constrained stereotypical choices. Our results indicated that children more frequently make strong preference inferences regardless of the actor's constraints when reasoning about gender stereotypical choices than when reasoning about neutral or counterstereotypical choices. We also find that older children are more likely than younger children to privilege constraint information. Finally, although acknowledging constraints was more common in neutral and counterstereotypical contexts, and among older children, the fact that this was not a highly robust tendency overall raises questions about when and why children privilege constraint information.

We found strong evidence that children override constraint information more when reasoning about stereotypical choices; this pattern held across two different measures and was not moderated by children's age. These results contrast with previous work finding that children's privileging of constraints is generally robust. One way to explain this divergence is that previous work has not yet examined contexts in which children already have strong prior beliefs about the target's preferences. As we posited earlier, prior beliefs may "tip the scales" such that they make constrained choices—even physically constrained choices—seem more informative than they would otherwise. While our focus here is on the effect of stereotype beliefs, it is possible that *any* prior beliefs that align with observed behavior affects reasoning about constraints. For example, imagine that a teacher

already assumes that a specific child dislikes school. If he sees this child sleeping in class, he may infer that this is further evidence of the child's dislike for school, even if he was aware that an environmental constraint (e.g., neighborhood noise disrupting the child's sleep) may have contributed to the current behavior. An important future direction is to understand how prior beliefs, both about individuals and social groups, may affect reasoning about constrained actions.

Our study also adds to the literature on developmental change in children's reasoning about constraints. We found age differences in this sample of U.S. children, such that older children were more sensitive to constraints than younger children, which may initially seem to contradict previous findings that U.S. children become *less* sensitive to constraints over development (Chernyak et al., 2019; Gopnik et al., 2017; Seiver et al., 2013). However, one explanation that resolves this inconsistency is that the current constraint was physical, as opposed to social. Indeed, there is evidence that reasoning about physical constraints is less sensitive to cultural influence (Chernyak et al., 2013) and becomes more robust across childhood (Pesowski et al., 2016). Our results thus map onto previous work finding that, with increasing age, children may possess greater cognitive capacities that facilitate their consideration of environmental (physical) influences (Cimpian & Steinberg, 2014; Hussak & Cimpian, 2018).

Although not tested directly in our study, our results also offer some insight into children's reasoning about *social* constraints. Specifically, if children strongly believe that people are socially constrained by gender roles and expectations (i.e., if children were aware of structural explanations for gender differences), they should be *especially* likely to refrain from inferring a preference in the stereotypical condition. That is, they should recognize that the girl is not only constrained by the height of the shelves, but also by social pressures to pick the doll, thus making a constrained stereotypical choice especially ambiguous. However, we find the *opposite* pattern, suggesting that children do not think about group stereotypes as a form of social constraints but rather as useful information that can be generalized to individual group members. Future studies could test whether first providing children with structural explanations for gender differences (Vasilyeva et al., 2018) may change this tendency.

A strength of the current design—in which children observe one action and are then asked about their preference inferences—is that it elucidates how children make inferences when they have limited observations of others. Indeed, there are many instances in daily life in which children are not afforded multiple observations when they make social inferences, nor are they able to observe others' choices across different situations. This becomes evident when considering the nature of stereotypical behavior, in which actors are consistently constrained by stable structural influences within society—for example, many girls face similar, stable constraints regarding what toys they are encouraged to play with.

At the same time, the fact that children only observed one action makes our study a rather conservative test of children's ability to acknowledge constraints. Indeed, other studies that have documented children's acknowledgment of constraints show children multiple actions (Kushnir et al., 2010), tell children what the actor always does when constrained and unconstrained (Jara-Ettinger et al., 2015), or, in the case of single actions, make the constrained toy attractive and the unconstrained toy unattractive (Pesowski et al., 2016)—all of which likely help children process constraints with greater ease. Thus, when it comes to estimates of children's *absolute* levels of acknowledging constraints, we may have underestimated these abilities. Nonetheless, we find robust evidence for our central question of interest, which was whether children would be *relatively* more likely to override constraint information when reasoning about stereotypical choices compared to neutral or counterstereotypical choices.

In addition to task factors, there are alternative, substantive explanations to consider for children's insensitivity to constraints. One explanation aligns with research on the *endowment effect* (Kahneman et al., 1990), in which people often come to like what they have. In our study, some children may similarly have reasoned that people like options that are available to them. Some initial support for this idea comes from our finding that children who override constraints were more likely to talk about the constraint in a *positive* light, for example, explaining that the character must like the constrained toy because "she can reach it easier" or stating, "Why would she like the truck more if she couldn't play with it or reach it?" This type of reasoning may also align with young children's assumption that social norms *are* preferences (Kalish & Shiverick, 2004). Indeed, children may assume that the choices that are available and socially acceptable ultimately shape people's preferences. More broadly, this finding raises questions about what inferences children make about the accessibility of different options (Huh & Friedman, 2019).

We also found that children were more sensitive to constraints in the counterstereotypical context than in the stereotypical context. This aligns with prior work suggesting that violations of expected behavior may make constraints more salient (Pesowski et al., 2016). Yet, the fact that children in the counterstereotypical condition were also most likely to override constraints and choice all together (i.e., inferring that the character likes the *unchosen* stereotypical toy, even if she freely chose the counterstereotypical toy) suggests a potentially troubling pattern. Specifically, this may suggest that children reject evidence indicating that there is greater variation in desires within a social group (e.g., that some girls prefer footballs over castles), and instead privilege group stereotypes. Moreover,

our results may indicate that children are especially eager to seek constraint explanations to justify such counterstereotypical behavior.

In navigating a social world with structural constraints, it is important for children to recognize that constrained choices, especially constrained choices that align with stereotypes, provide an incomplete window into a person's mental life. Our findings suggest, however, that children are the *least* likely to acknowledge the influence of constraints when choices align with stereotypes. These findings suggest that educational interventions may be needed to facilitate children's sensitivity to environmental constraint information when they make sense of well-known social group differences.

ACKNOWLEDGMENTS

The writing of this article was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number F32HD098777 awarded to Jamie Amemiya. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. We are grateful to the participating children and families.

ORCID

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

REFERENCES

Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science*, *355*, 389–391. https://doi.org/10.1126/science.aah6524

Bigler, R. S., & Liben, L. S. (2007). Developmental intergroup theory: Explaining and reducing children's social stereotyping and prejudice. *Current Directions in Psychological Science*, *16*, 162–166. https://doi.org/10.1111/j.1467-8721.2007.00496.x

Bonilla-Silva, E. (1997). Rethinking racism: Toward a structural interpretation. *American Sociological Review*, *62*, 465. https://doi.org/10.2307/2657316

Chernyak, N., Kang, C., & Kushnir, T. (2019). The cultural roots of free will beliefs: How Singaporean and U.S. children judge and explain possibilities for action in interpersonal contexts. *Developmental Psychology*, *55*, 866–876. https://doi.org/10.1037/dev0000670

Chernyak, N., Kushnir, T., Sullivan, K. M., & Wang, Q. (2013). A comparison of American and Nepalese children's concepts of freedom of choice and social constraint. *Cognitive Science*, *37*, 1343–1355. https://doi.org/10.1111/cogs.12046

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*, 461–480. https://doi.org/10.1017/S0140525X13002197

Cimpian, A., & Steinberg, O. D. (2014). The inherence heuristic across development: Systematic differences between children's and adults' explanations for everyday facts. *Cognitive Psychology*, *75*, 130–154. https://doi.org/10.1016/j.cogpsych.2014.09.001

Elenbaas, L., Rizzo, M. T., & Killen, M. (2020). A developmental science perspective on social inequality. *Current Directions in Psychological Science*, *29*, 610–616. https://doi.org/10.1177/0963721420964147

Gergely, G., & Csibra, G. (2003). Teleological reasoning in infancy: The naïve theory of rational action. *Trends in Cognitive Sciences*, *7*, 287–292. https://doi.org/10.1016/S1364-6613(03)00128-1

Gopnik, A., O'Grady, S., Lucas, C. G., Griffiths, T. L., Wente, A., Bridgers, S., Aboody, R., Fung, H., & Dahl, R. E. (2017). Changes in cognitive flexibility and hypothesis search across human life history from childhood to adolescence to adulthood. *Proceedings of the National Academy of Sciences of the United States of America*, *114*, 7892–7899. https://doi.org/10.1073/pnas.1700811114

Gopnik, A., & Wellman, H. M. (2012). Reconstructing constructivism: Causal models, Bayesian learning mechanisms, and the theory. *Psychological Bulletin*, *138*, 1085–1108. https://doi.org/10.1037/a0028044

Haslanger, S. (2016). What is a (social) structural explanation? *Philosophical Studies*, *173*, 113–130. https://doi.org/10.1007/s11098-014-0434-5

Hetey, R. C., & Eberhardt, J. L. (2018). The numbers don't speak for themselves: Racial disparities and the persistence of inequality in the criminal justice system. *Current Directions in Psychological Science*, *27*, 183–187. https://doi.org/10.1177/0963721418763931

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

Huh, M., & Friedman, O. (2019). Young children use supply and demand to infer desirability. *Developmental Psychology*, *55*, 2483–2490. https://doi.org/10.1037/dev0000833

Hussak, L. J., & Cimpian, A. (2018). Memory accessibility shapes explanation: Testing key claims of the inherence heuristic account. *Memory and Cognition*, *46*, 68–88. https://doi.org/10.3758/s13421-017-0746-8

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

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy*, *98*, 1325–1348. https://doi.org/10.1086/261737

Kalish, C. W., & Shiverick, S. M. (2004). Children's reasoning about norms and traits as motives for behavior. *Cognitive Development*, *19*, 401–416. https://doi.org/10.1016/j.cogdev.2004.05.004

Koenig, M. A., Tiberius, V., & Hamlin, J. K. (2019). Children's judgments of epistemic and moral agents: From situations to intentions. *Perspectives on Psychological Science*, *14*, 344–360. https://doi.org/10.1177/1745691618805452

Kushnir, T. (2018). The developmental and cultural psychology of free will. *Philosophy Compass*, *13*. https://doi.org/10.1111/phc3.12529

Kushnir, T., Gopnik, A., Chernyak, N., Seiver, E., & Wellman, H. M. (2015). Developing intuitions about free will between ages four and six. *Cognition*, *138*, 79–101. https://doi.org/10.1016/j.cognition.2015.01.003

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

Liu, S., Brooks, N. B., & Spelke, E. S. (2019). Origins of the concepts cause, cost, and goal in prereaching infants. *Proceedings of the National Academy of Sciences of the United States of America*, *116*, 17747–17752. https://doi.org/10.1073/pnas.1904410116

Liu, S., Ullman, T. D., Tenenbaum, J. B., & Spelke, E. S. (2017). Ten-month-old infants infer the value of goals from the costs of actions. *Science*, *358*, 1038–1041. https://doi.org/10.1126/science.aag2132

Luo, Y., & Baillargeon, R. (2007). Do 12.5-month-old infants consider what objects others can see when interpreting their actions? *Cognition*, *105*, 489–512. https://doi.org/10.1016/j.cognition.2006.10.007

Martin, C. L., Wood, C. H., & Little, J. K. (1990). The development of gender stereotype components. *Child Development*, *61*, 1891–1904. https://doi.org/10.1111/j.1467-8624.1990.tb03573.x

Mistry, R. S., Brown, C. S., Chow, K. A., & Collins, G. S. (2012). Increasing the complexity of young adolescents' beliefs about poverty and inequality: Results of an 8th grade social studies curriculum intervention. *Journal of Youth and Adolescence*, *41*, 704–716. https://doi.org/10.1007/s10964-011-9699-6

Noyes, A., & Keil, F. C. (2019). Generics designate kinds but not always essences. *Proceedings of the National Academy of Sciences of the United States of America*, *116*, 20354–20359. https://doi.org/10.1073/pnas.1900105116

Perfors, A., Tenenbaum, J. B., Griffiths, T. L., & Xu, F. (2011). A tutorial introduction to Bayesian models of cognitive development. *Cognition*, *120*, 302–321. https://doi.org/10.1016/j.cognition.2010.11.015

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. *Wiley Interdisciplinary Reviews: Cognitive Science*, *8*, 1–18. https://doi.org/10.1002/wcs.1437

Rizzo, M. T., Elenbaas, L., & Vanderbilt, K. E. (2018). Do children distinguish between resource inequalities with individual versus structural origins? *Child Development*, *91*, 439–455. https://doi.org/10.1111/cdev.13181

Roberts, S. O., & Rizzo, M. T. (2020). The psychology of American racism. *American Psychologist*, *76*, 475–487. https://doi.org/10.1037/amp0000642

Ruck, M. D., Mistry, R. S., & Flanagan, C. A. (2019). Children's and adolescents' understanding and experiences of economic inequality: An introduction to the special section. *Developmental Psychology*, *55*, 449–456. https://doi.org/10.1037/dev0000694

Schwarz, N. (1994). Judgment in a social context: Biases, shortcomings, and the logic of conversation. *Advances in Experimental Social Psychology*, *26*, 123–162. https://doi.org/10.1016/S0065-2601(08)60153-7

Seiver, E., Gopnik, A., & Goodman, N. D. (2013). Did she jump because she was the big sister or because the trampoline was safe? Causal inference and the development of social attribution. *Child Development*, *84*, 443–454. https://doi.org/10.1111/j.1467-8624.2012.01865.x

Stephens, N. M., Hamedani, M. G., Markus, H. R., Bergsieker, H. B., & Eloul, L. (2009). Why did they "choose" to stay? Perspectives of Hurricane Katrina observers and survivors. *Psychological Science*, *20*, 878–886. https://doi.org/10.1111/j.1467-9280.2009.02386.x

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

Wente, A. O., Bridgers, S., Zhao, X., Seiver, E., Zhu, L., & Gopnik, A. (2016). How universal are free will beliefs? Cultural differences in Chinese and U.S. 4- and 6-year-olds. *Child Development*, *87*, 666–676. https://doi.org/10.1111/cdev.12528

Woodward, A. L. (1998). Infants selectively encode the goal object of an actor's reach. *Cognition*, *69*, 1–34. https://doi.org/10.1016/S0010-0277(98)00058-4

Woodward, A. L. (1999). Infants' ability to distinguish between purposeful and non-purposeful behaviors. *Infant Behavior and Development*, *22*, 145–160. https://doi.org/10.1016/S0163-6383(99)00007-7

Woodward, A. L. (2009). Infants' grasp of others' intentions. *Current Directions in Psychological Science*, *18*, 53–57. https://doi.org/10.1111/j.1467-8721.2009.01605.x

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: 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*, 00, 1–12. https://doi.org/10.1111/cdev.13643