Which group matters more: The relative strength of minimal vs. gender and race group memberships in children's intergroup thinking

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ABSTRACT

Experimentally created "minimal" social groups are frequently used as a means to investigate core components of intergroup cognition in children and adults. Yet, it is unclear how the effects of such arbitrary group memberships compare to those of salient real-world group memberships (gender and race) when they are directly pitted against each other in the same studies. Across three studies, we investigate these comparisons in 4–7-year-olds. Study 1 ($N = 48$) establishes the minimal group paradigm, finding that children develop ingroup preferences as well as other forms of group-based reasoning (e.g., moral obligations) following random assignment to a minimal group. Study 2 ($N = 96$) and Study 3 ($N = 48$) directly compare this minimal group to a real-world social group (gender or race) in a cross-categorization paradigm, in which targets are participants' ingroups in terms of the minimal group and outgroups in terms of a real-world social group, or vice versa. The relative strength of the minimal group varies, but in general it either has a similar effect or a stronger effect as compared to race and in some cases even gender. Our results support the contention that an abstract tendency to divide the world into "us" and "them" is a central force in early intergroup cognition.

1. Introduction

When young children begin to navigate the social world, one salient thing they notice is that individuals cluster into a range of social groups, from gender and race/ethnicity, to language and more. Children are sensitive to these group memberships from a surprisingly young age. Even infants and children under age 3 prefer individuals who are similar to them in terms of gender, age, and language, and within a few years they also develop preferences relating to race and ethnicity (Aboud, 1988; Buttelmann et al., 2013; Kinzler et al., 2007; Shutts et al., 2010). Social categories such as gender and race have rich cultural meanings that likely vary considerably across children as a function of different cultural and environmental input. Underneath this complexity, however, each of these distinctions invites children to make a basic conceptual distinction between ingroup and outgroup, between "us" and "them."

To what extent does children's reasoning about and attitudes towards groups stem from cultural learning about specific groups (such as gender or race) versus a more abstract or generalized response to an intergroup boundary ("us" vs. "them")? The work with so-called "minimal groups" bears on this question, finding that children and adults affiliate with

previously unfamiliar groups that have neither evolutionary nor real-world significance (Tajfel et al., 1971; e.g., Bigler et al., 2001; Richter et al., 2016; Yang & Dunham, 2019a; for a review, see Dunham, 2018). These findings suggest that children represent generic ingroup and outgroup members differently, and have a basic tendency to affiliate with and prefer ingroup members even for groups that are of minimal real-life significance. But how do these findings with minimal groups relate to previously mentioned findings with culturally salient real-world groups such as gender and race?

One possibility is that preference for minimal ingroups is a sort of "over hypothesis" based on generalizing from preferences for multiple real-world ingroups (e.g.., the generalization that one does or should prefer ingroups). Such an effect should only emerge after children have developed biases towards a number of real-world social groups, and we might also expect that the minimal group effect would be weaker than the biases towards real-world social groups that the minimal group effect is based on. Conversely, the minimal group effect could be an initial template over which other group representations form; that is, the general and abstract tendency to prefer ingroups could itself be one of the drivers of bias towards real-world social groups, in which case it

could be equally strong or even stronger than real-world bias, at least early in development. Thus, a direct comparison of the strength of minimal and real group effects provides a means of shedding light on these possibilities, which is the focus of our current paper.

1.1. How do minimal group effects compare to real-world group effects?

To our knowledge, there is surprisingly little work examining the question of how minimal group effects relate to real-world group effects in children. A review of the adult literature on this question suggests mixed results. Some researchers find that ingroup biases are stronger among real groups as compared to artificial groups; some find the reversed pattern; and others find no difference (see meta-analyses by Balliet et al., 2014, Mullen et al., 1992, and Lane, 2016). However, most of these findings are based on meta-analyses that compared the effects of minimal versus real social groups that had been independently assessed in separate studies. These studies also differ in other respects (e.g., how minimal groups are operationalized, what measures are employed), making the conclusions somewhat less definitive. Perhaps most importantly, since studies have not directly compared different forms of group bias, it is unclear whether the minimal group or the real groups would have stronger effects when they are pitted against each other. Further, all these studies are conducted with adults. Since adults already have extensive cultural experiences with different groups, the effects may reflect simple generalizations from their accumulated experiences and expectations towards the groups. Hence, they might obscure the basic tendencies and relative strengths of minimal and real group biases in children. Indeed, it has been proposed that minimal group bias is a consequence of the cultural and linguistic meaning of dichotomous categorization, internalized over years of social learning (Spielman, 2000). This implies an increase in the strength of minimal groups over development, making developmental research a unique lens through which to explore this question (Dunham & Olson, 2008).

With these thoughts in mind, the present investigation directly pits minimal and highly salient real-world groups against one another in a within-participants design, doing so early enough in life that generalization from multiple real-world groups to minimal groups is at least less plausible. We focus on two salient real groups, gender and race, both of which are particularly psychologically salient for adults and have received the most attention among developmental researchers (e.g., Stangor et al., 1992; Yang & Dunham, 2019b). Gender is one of the most salient social categories for children. By age one, infants seem to be able to recognize gender from human faces because they divide their attention differently between male and female faces (Quinn et al., 2002). Between ages two and five, children start to prefer peers of their own gender (e.g., Dunham et al., 2015; Yee & Brown, 1994). Unlike the early-developing preferences based on gender, children under age three do not reliably show meaningful social preferences based on race. For example, they do not selectively accept or give toys from or to same-race versus other-race individuals, nor do they rate other-race individuals more negatively than same-race individuals (Kinzler & Spelke, 2011; Shutts et al., 2010). Existing evidence consistently suggests that race-based preferences emerge somewhat later in life, at around four or five years of age (Aboud, 2003; Dunham et al., 2013; Kinzler & Spelke, 2011; see also Krieger et al., 2020 for evidence in selective social learning).

1.2. Beyond preferences: intuitive theories of social groups

Beyond showing preferences for their social ingroup members over members of the other groups, children also make other kinds of inferences based on social category memberships. These inferences have been linked to two distinct intuitive theories of groups — an essentialist theory and a coalitional theory — and might be part of children's "naïve sociology" (Rhodes, 2012). These intuitive theories capture children's reasoning about the nature of social group memberships (e.g., are they stable over time and indicative of key properties? Are they meaningful in

marking social obligations?).

The first intuitive theory considers social categories as markers for natural kinds, that is, thinking that category memberships are likely to be determined by birth, stable, and indicative of shared fundamental similarities (i.e., the *essentialist* theory). Research suggests that children's understandings of gender (Diesendruck & haLevi, 2006; Rhodes & Gelman, 2009; Taylor et al., 2009; cf. Shutts et al., 2013) plausibly fit this theory. Critically, children do not initially apply this view to other social categories such as race (Rhodes & Gelman, 2009; Shutts, 2013; Waxman, 2010). It is unclear whether children view minimal groups as more similar to gender or to race on this dimension; the current study explores this question.

The second intuitive theory holds that social categories mark intrinsic social obligations between group members (i.e., the *coalitional* theory). Unlike the essentialist theory, children readily apply this thinking to gender, race, and even previously unfamiliar groups. For example, children as young as four predict that social affiliations like friendship will cluster based on gender and race (Shutts et al., 2013), and even infants seem to expect ingroup members to support each other such that they are surprised and look longer if that is not the case (Jin & Baillargeon, 2017). Children also consider unfamiliar groups to be grounded in the shared intentions of group members to interact (Noyes & Dunham, 2017). Further, they appear to evaluate within-group harm as intrinsically wrong in unfamiliar social groups, leading them to think that it is more okay to harm outgroup members than ingroup members as long as there is no rule against harm (Rhodes & Chalik, 2013). After age 6 they also expect ingroup members to direct positive behavior such as helping towards fellow ingroup members even when groups are unfamiliar (Rhodes, 2012). However, most of these studies have investigated children's third-party judgments of groups to which they did not belong; it remains an open question whether children make similar inferences about groups they belong to (e.g. whether they would expect an outgroup member to direct harm towards the child's own group). The current work investigates both of these issues while always directly pitting gender or race against a minimal group.

1.3. The present study

The present paper aims to examine the relative strength of minimal group effects when directly contrasted with real social groups (in this case gender and race). We include comparisons of children's ingroup bias in the form of their explicit preference, as well as their tendency to apply two intuitive theories of groups, namely an essentialist theory about shared kind membership and a coalitional theory about intrinsic within-group obligations. From early childhood to middle childhood, children's naïve theories of groups and their stereotypes of groups become more comprehensive (Rhodes, 2012; Sigelman et al., 1986). Therefore, we focus on two age groups, 4- and 5-year-olds and 6- and 7-year-olds, which straddle this reported change in intergroup reasoning. This allows us to examine whether children's differentiation of minimal versus real-world social categories changes with age.

While not definitive, different patterns of results would support different accounts of why minimal group biases exist. If the minimal group represents a basic schema that is shared with real groups ("us" versus "them"), we might expect minimal and real-world groups to be similar in strength in 4- and 5-year-olds. By contrast, if minimal group effects are a generalization or abstraction from children's reasoning about multiple real-world groups (e.g., after internalizing the cultural and linguistic meaning of dichotomous categorization; Spielman, 2000), we would expect minimal group effects to initially be absent or at least weaker than salient and familiar real groups (in 4- and 5-year-olds) and they might become more similar in strength around ages 6 and 7. To be clear, most existing studies on minimal group effects focus on the *existence* of the phenomenon; our study contributes to a further understanding of the relative *strength* of the effects in comparison to the presence of a second salient real-group contrast, which potentially sheds

light on the *mechanism* of the intergroup effects.

In Study 1, we establish baseline results with a minimal groups paradigm focusing on these three measures in order to make sure we induce minimal group biases when there is no competing group dimensions. In Study 2, we construct minimal groups in the same manner and then pit them directly against a real-world social group (race or gender) in which social targets are always ingroup along one dimension and outgroup along the competing dimension. In Study 3, we simplify the tasks and further probe the relative magnitude of effects between the minimal group and a real group (gender or race).

2. Study 1

The goal of this study was to assess minimal group effects in terms of children's ingroup preferences and their naïve theories, thereby ensuring that we have a procedure in place that replicates past findings on minimal group biases. This way we can build upon this procedure to compare minimal group effects with real-world groups in Study 2 and 3. We included three measures: children's explicit preferences towards ingroup vs. outgroup members (hereafter *preferences*), children's inductive generalizations based on minimal group membership (hereafter *generalizations*), and children's use of group membership as markers of interpersonal moral obligations (hereafter *obligations*). These three measures allow us to assess the basic tendency towards ingroup preference while also including some measures corresponding to children's richer intuitions about how groups function.

2.1. Method

2.1.1. Participants

Power analyses indicated that total $n = 47$ was required to detect a small to medium effect with >80 % power (linear multiple regression in a random model, two tails, up to 3 predictors, $\alpha = 0.05$, $\rho^2 = 0.25$; using G*Power). Our final sample included 48 children, mostly between the ages of 4 and 7 ($M = 5.85$, $SD = 1.30$, range $= 3.75$ to 7.99; 27 females, 21 males; the majority of the participants were European Americans). Participants were tested one-on-one in the lab, at local museums, or at local schools in New England with a trained experimenter. Given the demographic profiles of our data collection sites (i.e., a university database, private schools, and museums), we believe that most participants came from middle-class families. Studies reported in this paper were approved by [blinded for peer review]. Written parental consent was obtained in advance of all testing; children also provided verbal assent prior to beginning the procedures.

2.1.2. Procedures

Following the random assignment procedures in Dunham et al. (2011), children were shown a green token and an orange token, which were then hidden behind the experimenter's back and shuffled. The experimenter brought her hands forward, with one token in each hand, and asked the child to select a hand. Depending on the token selected, the experimenter told the child he or she would now be in a green or orange group. Children then put on a t-shirt of the corresponding color and were told they would now view photographs of other children from these groups on the computer. Children answered comprehension check questions (to indicate four other children's minimal group memberships from their photos using the visual cue of t-shirt colors; "Which group is this child in?") before going through the measures described next. All children passed the comprehension check. After children finished all three measures, they were asked one manipulation check question about which group they belonged to. All children successfully answered this question.

2.1.3. Stimuli

Stimuli were sixteen full-color head and shoulders photographs of European American children (eight boys and eight girls) between the

ages of 5 and 7, with photographs matched with participant gender (following past literature on minimal group biases in children, e.g., Dunham et al., 2011). Photographs were edited using image-editing software such that half the children in each gender wore green and the other half wore orange t-shirts (for a total of four boys and four girls per minimal group). Preliminary adult ratings collected for a prior study employing these stimuli (Dunham et al., 2011; asking for ratings on attractiveness using a Likert-like scale and estimations of age) indicated the target children in each group were approximately equal in attractiveness and age.

2.1.4. Measures

Each participant completed three measures: *preferences*, *generalizations* and *obligations*. The *preferences* measure was always presented first followed by the other two measures in a counterbalanced order for all of the studies reported in this paper. This was determined so that participants' attitudes towards the targets were not influenced by what they heard about the targets on the *generalizations* and *obligations* measures, which ascribed various properties and actions to group members. Children completed four trials in a randomized order for each measure. No labels of group memberships or gender pronouns were mentioned in any of the trials.

2.1.4.1. Preferences. On each trial, children saw a pair of targets presented side-by-side, one after the other, with contrasting minimal group memberships. The order of appearance and the left/right position of the targets were counterbalanced. When each target appeared, the experimenter drew the child's attention by pointing to the photograph and said: "this is a (another) child". The child was asked to indicate, in a forced-choice manner, which target they liked better. If children prefer their minimal ingroup, they should be more likely to select ingroup targets.

2.1.4.2. Generalizations. On each trial, children first saw a protagonist from one minimal group appear in the center of the screen. The experimenter pointed to this protagonist and introduced a novel property, e. g., "This is a child. This child has a tomma inside". Then a pair of targets from the contrasting groups appeared one after the other on the bottom of the screen. The experimenter again pointed to and introduced each target (i.e., "Here is a child. Here is another child"). The child was asked to decide which of the two targets shared the novel property with the protagonist (adapted from Gelman et al., 1986). Each of the four trials featured a different type of novel property: biological ("has a tomma inside"), behavioral ("gorps everyday"), cognitive ("thinks gobe is bad") and psychological ("likes to eat wag"). Half of trials featured a green group protagonist and the other half featured an orange group protagonist. If children think of these minimal groups as inductively rich social categories, they should generalize novel properties to a new individual who shares the group membership with the protagonist.

2.1.4.3. Obligations. On each trial, the experimenter first introduced a positive or negative moral behavior performed by protagonist from one of the minimal groups, e.g. "This is a child. This child shared a toy with/ stole a toy from someone." Then a pair of targets appeared in the same manner as described above, with contrasting group memberships. The experimenter introduced each target when they appeared. The child was asked to decide which target was the recipient of the protagonist's behavior. There were two prosocial trials (i.e., helping and sharing) and two antisocial trials (i.e., hitting and stealing), with the group membership of the agent counterbalanced cross the two types of trials. If children consider minimal groups to be markers of coalitional structure, they should expect negative actions to occur between groups and positive actions to occur within groups (Rhodes, 2012).

2.2. Coding and analysis

Responses were coded as 1 if participants showed minimal ingroup biases, i.e., preferring their minimal ingroup members (*preferences*), expecting the protagonist's minimal ingroup member to share the novel property of the protagonist (*generalizations*), and expecting the recipient of prosocial behaviors to be the protagonist's minimal ingroup and the recipient of antisocial behaviors to be the protagonist's minimal outgroup (*obligations*). Responses indicating outgroup biases were scored as 0.

Preliminary analyses revealed no effects of participant gender and color of the group the child was assigned to; further, for the *generalizations* and *obligations* measures there were no effects of whether the character introduced first was the child's ingroup or outgroup. We also did not expect any effects concerning these factors; therefore, they will not be discussed further. We analyzed whether there were any age differences between the younger children (4–5-year-olds, $N = 24$) and the older children (6–7-year-olds, $N = 24$) for each measure. To capture the repeated measures nature of the data, for each measure, data were analyzed in a mixed-effects logistic model with trials nested within participants. Across the models, we included age group (older vs. younger) as a predictor; for the obligations measure, we also included trial valence (prosocial vs. antisocial) and the age group by valence interaction as predictors. If these predictors did not improve model fit, we removed them from the final models (one by one, dropping the least significant term first). Effect sizes for all measures are reported as odds ratios (*ORs*) indicating the increased likelihood of choosing the ingroup as opposed to the outgroup target.

2.3. Results

All data and analysis code to replicate all findings and create all figures can be found at: https://osf.io/4suz2/?view_only=61eb56bbf642402e92e7907cf5bbe87c (blinded for peer review). We examine results for each measure separately and present those results in Fig. 1.

2.3.1. Preferences

As shown in Fig. 1, there was a significant minimal ingroup preference. Participants preferred ingroup members on 69 % of the trials, and were 2.31 times more likely to prefer the ingroup member to the
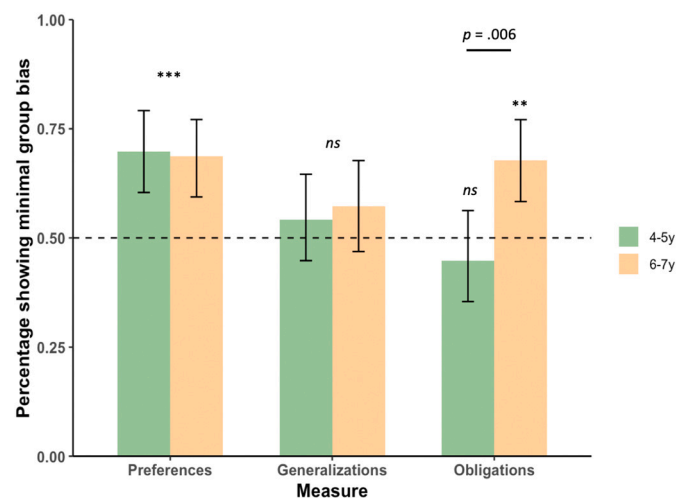
outgroup member: 95 % confidence interval of the *OR* = [1.64, 3.25], $\beta = 0.84$, $SE = 0.18$, $p < .001$. There was no effect of age group, $p = .88$.

2.3.2. Generalizations

Children did not use minimal group memberships as a basis to infer novel properties. As shown in Fig. 1, they expected the protagonist to share the novel property with the protagonist's ingroup members as opposed to outgroup members on 56 % of the trials, $OR = 1.35$, 95 % CI = [0.86, 2.12], $\beta = 0.30$, $SE = 0.23$, $p = .19$. The type of novel property (e.g. biological versus preference) did not affect children's responses, $p = .31$. Children's responses did not differ as a function of age group, $p = .70$.

2.3.3. Obligations

Overall, participants used minimal group memberships as markers of obligations (choosing the protagonist's ingroups as recipients of prosocial behaviors and choosing the protagonist's outgroups as recipients of antisocial behaviors) on 56 % of the trials, but this varied as a function of age group, $\beta = 1.07$, $SE = 0.39$, $p = .006$ (see Fig. 1). Four-and 5-year-olds did not demonstrate this tendency: they showed this tendency on 45 % of trials, which was not significantly different from chance, $p = .37$. In contrast, six- and 7-year-olds used minimal group memberships as an indicator of coalitional obligations on 68 % of trials, $OR = 2.30$, 95 % CI = [1.32, 4.02], $\beta = 0.84$, $SE = 0.28$, $p = .003$. In other words, older children were 2.3 times more likely to indicate prosocial behaviors towards ingroups as compared to outgroups and antisocial behaviors towards outgroups as compared to ingroups. The effect of valence and the interaction between age group and valence were both not significant (*ps* > .11).

2.4. Discussion

Consistent with previous research (e.g., Baron & Dunham, 2015; Dunham et al., 2011; Dunham & Emory, 2014; Yang & Dunham, 2019a), we found that children preferred their minimal ingroup members to their minimal outgroup members. This ingroup preference was present in children as young as 4 years of age and did not change with age during ages 4–7. We also found that children did not expect group members to share novel properties with other members of the same group. This is consistent with the view that children do not expect social categories to indicate fundamental similarities between ingroup members (Rhodes, 2012; Rhodes & Gelman, 2009; Shutts, 2013; Waxman, 2010), though they may come to do so when given additional information that suggests the category is essentialized, such as generic language (Rhodes et al., 2012).

At the same time, we found that older children but not younger ones used minimal group membership to make inferences about interpersonal moral obligations: they expected antisocial actions to happen between groups and prosocial actions to happen within groups. Previous research found similar results using novel groups in which members had collaborations with each other (Rhodes, 2012; Rhodes & Chalik, 2013), and our findings demonstrate that 6- and 7-year-old children have similar expectations for minimal groups without receiving information about within-group interactions. Contrary to previous findings that 4- and 5-year-olds predict between group harm (Rhodes, 2012), we did not find reliable expectations among this younger group in our study. This is not surprising given that our group context was truly minimal; there is evidence that children at this young age do not use groups to make verbal predictions about social actions unless there is functional information or if the categories are made more salient through increased exposure and learning, or through the presence of additional factors such as between-group competition (Rhodes, 2012; but see the looking-time studies using different methodologies with toddlers, Jin & Baillargeon, 2017). What our results do suggest is that by age 6, children's expectations for interpersonal obligations based on group memberships are strong enough that they spontaneously engage in coalitional reasoning even for

Fig. 1. Percentage showing minimal group bias across age groups and measures in Study 1.
Note: For all figures, regression results comparing to chance (0.5) for each measure were shown with notations ***p < .001, **p < .01, *p < .05, ~*p* < .01, and *ns*. If the effect of age group was significant, *p* values above solid lines were shown using the same notations.

minimal groups in the absence of additional information that characterizes the groups or their patterns of interaction.

Taken together, our results suggest that by merely belonging to a minimal group, children show preferences for their ingroup members over outgroup members, and they treat minimal groups as indicative of coalitional obligations but do not see them as *natural kinds* that share a range of unobserved properties.

3. Study 2

In Study 2, we compare minimal group effects to highly salient real social groups. We first assigned children to a minimal group (as in Study 1) and then via a crossed-categorization paradigm, we presented them with stimuli that pitted their minimal group membership against one real social group (gender or race). More specifically, for every pair of targets that participants saw, they always shared minimal group membership with one of the targets and shared real group membership with the other target. Studies using similar paradigms suggest that children and adults are able to categorize targets based on multiple dimensions (Brown & Turner, 1979; Deschamps & Doise, 1978; Urban & Miller, 1998). Previous work with adults suggests that this paradigm can reveal whether the dimensions are equal in strength or if one dimension is stronger than the other (e.g., Stangor et al., 1992; Urada & Miller, 2000; Urban & Miller, 1998). This method allows us to systematically and directly compare the relative strengths of minimal group effects with the real social group effects. We used a between-subjects design in this study: participants were assigned to either the Gender condition where the minimal group was pitted against gender, or the Race condition where the minimal group was pitted against race.

3.1. Method

3.1.1. Participants

As specified in Study 1, following power analyses we planned for testing $N = 48$ (with $N = 24$ in each age group) for each of the two between-subject conditions: minimal vs. gender and minimal vs. race.[1] Our sample included 96 children, with 48 children in each condition ($M = 5.96$ years, $SD = 1.14$ years, range = 3.83 to 7.83, 48 females, 48 males). There were 24 four- and 5-year-olds and 24 six- and 7-year-olds in each condition. Given that the majority of the participants from our data collection sites were White European American, to make sure the stimuli had the same meaning to all participants rather than depending on their own racial groups, we only recruited White European American for the *Race* condition. The majority of the participants in the *Gender* condition were White European American, reflecting the demographics of our data collection sites.

3.1.2. Procedures

Children were assigned to one of the experimental conditions: *Gender* or *Race*. As in Study 1, we asked comprehension check questions before main measures and a manipulation check question (i.e., which minimal group were you in) at the end of the session. All children passed the comprehension checks; one child in the *Gender* condition and one child in the *Race* condition failed the manipulation check and were excluded. We added one additional participant in each of these two conditions to meet our pre-planned target of $N = 48$ per condition.

3.1.3. Stimuli

We used photograph stimuli similar to those in Study 1. The only exception was that in the *Race* condition, half of the stimuli featured

White American children and half featured African American children, and they were gender-matched to the participants.

3.1.4. Measures

Similar to Study 1, each participant completed the *preferences* measure first, followed by the *generalizations* and *obligations* in a counterbalanced order. There were 4 trials for each measure.

3.1.4.1. Preferences.
This measure was identical to that in Study 1, except for the addition of real group membership information presented via the stimuli. On each trial, one of the targets was the child participant's minimal ingroup and real group outgroup (gender or race outgroup, depending on condition), while the other target was the child participant's minimal outgroup and real group ingroup. In other words, the child participant shared with each target *either* minimal group membership *or* real-world group membership. This task thus measures children's relative preferences for their minimal versus real-world ingroup.

3.1.4.2. Generalizations.
This measure was identical to that in Study 1 except for the addition of real group membership information presented via the stimuli. On each trial, a protagonist was introduced, followed by two targets that either shared minimal group membership or real group membership with the protagonist, in the similar manner as described above. Participants were asked to indicate whether the protagonist's minimal ingroup member (who was also their real-world outgroup member) or real-world ingroup member (minimal outgroup member) shared the novel property ascribed to the protagonist. Thus, this task assesses whether children expected novel properties to generalize within a minimal or a real-world group.

3.1.4.3. Obligations.
This measure was identical to that in Study 1, except for the addition of real group membership information presented in the same way as in the *Generalizations* measure. This task assesses whether children expected moral obligations to generalize within a minimal or a real-world group.

3.2. Coding and analysis

We used similar coding and analyses for each measure as those in Study 1. Responses were coded as 1 (minimal group bias) if participants preferred their minimal ingroup (*preferences*), expected minimal ingroups to share novel properties (*generalizations*), and expected the recipient of prosocial behaviors to be a minimal ingroup of the protagonist and the recipient of antisocial behaviors to be a minimal outgroup of the protagonist (*obligations*). Responses that indicated real-world group biases were scored as 0 (real group bias). Preliminary analyses across conditions revealed no effects of participant gender and minimal group color for all three measures or the identities of the protagonist in the *generalizations* and *obligations* measures, so these factors were not included in subsequent analyses.

3.3. Results

We first examined the interaction effects between measure, condition, and age group in predicting children's responses. Our 2 (age group: younger vs. older) × 3 (measure: preferences, generalizations, obligations) × 2 (condition: gender, race) model revealed that the 3-way interaction did not improve overall model fit, $p = .93$. Examination of the pairwise 2-way interactions revealed that only the interaction between measure and condition significantly improved model fit, Likelihood ratio test $\chi^2(2, N = 96) = 8.04$, $p = .02$, while the other two-way interactions were not significant, $ps > .51$. Given the interaction between measure and condition and the main focus in the current work on effects on each measure in each condition, we examine results for each

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[1] We had planned a third condition involving (auditory) language, which ended up not being interpretable due to background noise in our primary testing location, and thus is not reported in this manuscript. Details are available upon request.

condition and measure separately and present those results in Fig. 2.

3.3.1. Gender condition

Children preferred their gender ingroup over their minimal ingroup on 66 % of trials, which was 2.25 times more frequently than they did otherwise: 95 % CI = [1.41, 3.61], $\beta = -0.81$, $SE = 0.24$, $p < .001$. The results for the *generalizations* measure differed in the opposite direction: participants expected the protagonist to share the novel property with minimal ingroup members on 59 % of the trials, 1.47 times more frequently than they did for gender ingroup members, 95 % CI = [1.09, 1.99], $\beta = 0.39$, $SE = 0.15$, $p = .01$. There was no effect of age group on these two measures ($ps > .56$). On the *obligations* measure, however, participants did not display a significant bias in either direction, $OR = 1.16$, 95 % CI = [0.87, 1.54], $\beta = 0.15$, $SE = 0.14$, $p = .31$. Descriptively, they showed minimal ingroup bias on 54 % of the trials (i.e., expecting prosocial behaviors to happen within minimal groups and antisocial behaviors to happen between minimal groups). The effects of age group and valence were both not significant ($ps > .19$), but there was a significant age group by valence interaction, $\beta = -1.45$, $SE = 0.59$, $p = .01$, driven by 4- and 5-year-olds showing stronger minimal group biases on prosocial trials as compared to antisocial trials ($OR = 3.05$, 95 % CI = [1.33, 7.03], $\beta = 1.12$, $SE = 0.43$, $p = .009$) while older children did not show an effect of valence ($p = .41$).

3.3.2. Race condition

Children did not show a significant bias towards either direction (minimal group or race) across all three measures. On the *preferences* measure, participants preferred race ingroup members on 52 % of the trials, $p = .73$. On the *generalizations* measure, participants expected the protagonist to share novel properties with minimal ingroup members on 55 % of the trials, $p = .30$. No age effects were found for these two measures, $ps > .58$. On the *obligations* measure, overall on 54 % of the trials participants showed minimal group bias, $p = 31$. The effects of age group and valence and the age group ×valence interaction were all non-significant, $ps > .31$.

3.4. Discussion

In this study we directly compared the strength of the minimal group and real-world groups (gender and race) for three prominent measures of intergroup cognition. When gender was pitted against the minimal group, 4- to 7-year-old children preferred gender ingroups to minimal ingroups. Children's early-emerging and strong gender bias is well established in the literature (e.g., Yee & Brown, 1994), and our results further demonstrate that children's gender ingroup preferences are stronger than their minimal ingroup preferences (see also Dunham et al., 2011). Interestingly, we found the opposite pattern for the *generalizations* measure: children expected novel properties to generalize within minimal rather than gender groups. However, children did not generalize the properties within minimal ingroup members in Study 1. Placing these findings side-by-side, it seems that children thought gender ingroup members were particularly *unlikely* to share novel properties (cf Shutts, 2013). One possibility here is that children deemed a *novel* social category (i.e., a minimal group) to be a more likely basis for shared *novel* properties compared to gender category (which is at least more biologically-based), and perhaps children would generalize familiar properties to gender over the minimal group, a possibility we explored in Study 3. Additionally, children did not favor either minimal group membership or gender in reasoning about moral *obligations*. Given that older children used the minimal group as a basis for coalitional reasoning in Study 1, these results further suggest that they viewed minimal group and gender as indicative of moral obligations to a similar extent.

Turning to the race condition, children did not show a clear pattern on any of the measures. In other words, minimal ingroup biases seem to be equally strong as race-based biases.

This implies that the effects of race are similar in power to those of the minimal group in terms of influencing children's attitudes and indicating shared properties and moral obligations.

4. Study 3

Study 3 aims to further probe the relative strength of minimal vs. real groups in children's group-based reasoning using simplified tasks. In the generalizations and obligations measures in Study 2, children reasoned about third-party protagonists in relation to two other targets, while also belonging to one of the groups. This design added complexity to the two measures and was not directly comparable to the preference measure (which was a first-party measure). We conducted a pre-registered Study 3 using first-party reasoning measures that only involved two target children with contrasting group memberships on each trial. Because the simplified tasks were clearer and shorter, we were able to use a within-subject design (each participant went through both the Gender and the Race conditions) to increase power (pre-registration link https://as
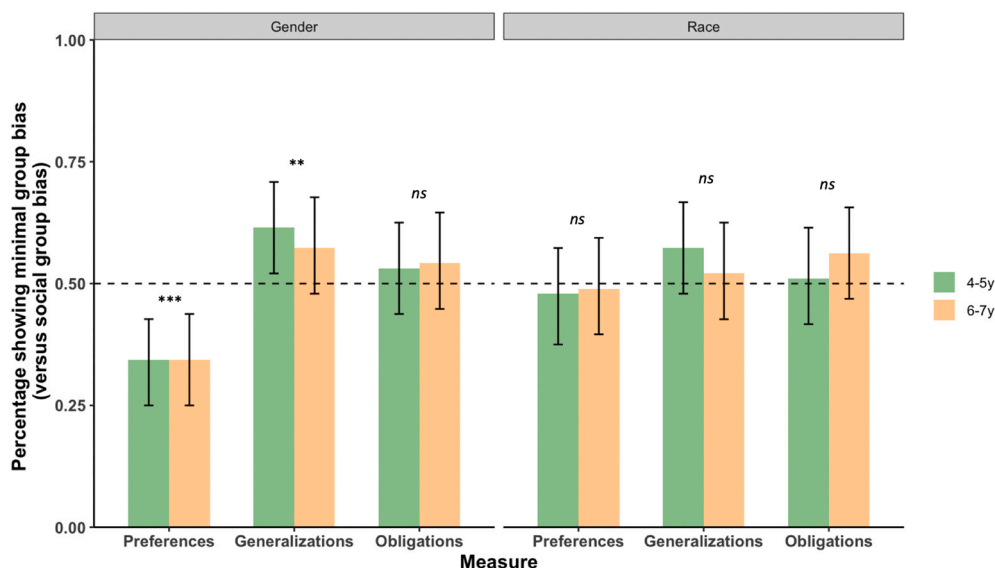

Fig. 2. Percentage showing minimal group bias (versus real social-group bias) across age groups and measures for the Gender and Race conditions in Study 2.

predicted.org/blind.php?x=fy2dx8).

4.1. Method

4.1.1. Participants

Our final sample included 48 children between the ages of 4 and 7, and they went through both the *Gender* and *Race* conditions in a randomized order ($M = 6.05$ years, $SD = 1.08$ years, range = 4.17 to 7.85, 24 females, 24 males), with sample sized determined in the same manner as Study 1 and 2. There were also 24 4–5-year-olds and 24 6–7-year-olds. Children were recruited and tested in a campus lab or at two local museums. Three additional children were tested but excluded from data analyses due to failure to pass the final manipulation check question ($n = 1$), sibling interference ($n = 1$), or unwillingness to continue participating in the study ($n = 1$). Similar to Study 2 (*Race* condition), all participants tested in this study were European American participants so as to make sure that the stimuli in the *Race* condition had the same meaning for all participants.

4.1.2. Procedures

We made two major changes from Study 2 to Study 3. First, in order to further probe children's group-based reasoning, we simplified the generalizations and obligations measures, such that on each trial, participants only saw two contrasting targets and answered first-party questions (e.g., which child helped you; see *Measures* below for details). Second, as the simplified measures took up less amount of time, we were able to use a within-subject design to increase power (Gender and Race conditions presented in a randomized order). There was a brief break in between the Gender and the Race conditions. Given that we did not find an effect of the minimal group color (green vs. orange) in previous studies, all participants were assigned to the green group in Study 3 to simplify the procedure. Participants then put on a green t-shirt and answered comprehension check questions (indicating minimal group memberships from photographs) before main measures. They answered a final manipulation check question after completing all measures (on which minimal group they had been in). One participant did not pass the final manipulation check was thus excluded from data analyses.

4.1.3. Stimuli

We used photograph stimuli similar to those in Study 2.

4.1.4. Measures

Participants completed three measures in each condition with four trials for each condition: *preferences, generalizations* and *obligations*. The measures for each condition were presented in the same order as in Studies 1 and 2.

4.1.4.1. Preferences.
The *preferences* measure was identical to that in Study 2.

4.1.4.2. Generalizations.
The *generalizations* measure was simplified from that in Study 2 (from third-party to first-party). We used familiar properties that participants could relate to (i.e., liking of snacks, storybook, games, and animals; adapted from the similarity measure in Yang & Dunham, 2019a) instead of novel properties because this is a first-party task asking participants to generalize their own properties to another individual. On each trial, photographs of two target children were presented, with one being the participant's minimal ingroup (and real-world outgroup member) and the other being the participant's minimal outgroup (and real-world ingroup member). Participants were asked to guess who was similar to them (e.g., "One of these kids likes the same snacks as you. Who do you think likes the same snacks as you?"). Thus, this task assessed whether children expected their own properties to generalize within a minimal group or a real-world social group.

4.1.4.3. Obligations.
The *obligations* measure was simplified from that in Study 2. On each trial, we displayed photographs of two target children in the same manner as described on the *generalizations* measure above. Participants were asked to guess who did a hypothetical prosocial or antisocial action towards them (items were helping, sharing a toy, hitting, and stealing a toy; e.g., "Imagine that a kid helped you today. Which kid do you think helped you today?"). Thus, this task assessed whether children expected moral obligations to generalize within a minimal or a real-world social group when themselves were recipients of the actions.

4.2. Coding and analysis

We used the same coding and analysis strategies for each measure as those in Study 2. Responses were coded as 1 if participants showed minimal ingroup bias, i.e., preferring their minimal ingroup members (*preferences*), expecting minimal ingroup members to share similar properties with them (*generalizations*), and expecting themselves to be the recipients of minimal ingroup members' prosocial behaviors and minimal outgroups' antisocial behaviors (*obligations*). Responses indicating real-world social group biases were scored as 0.

Preliminary analyses revealed no effects of participant gender, condition order, or measure order, so these factors were not included in subsequent analyses.[2] Data were then analyzed in the manner described in Study 2, above.

4.3. Results

Following our pre-registered analysis plan, we first examined the interaction effects between measure, condition, and age group in predicting children's responses (similar model as specified in Study 2). The 3-way interaction did not improve overall model fit, $p = .12$. Examination of the pairwise 2-way interactions revealed that the interactions between age group and condition, and between age group and measure significantly improved model fit, Likelihood ratio test $\chi^2(1, N = 48) = 5.01$, $p = .03$ and $\chi^2(1, N = 48) = 9.61$, $p = .008$, while the interaction between condition and measure was not significant, $p = .58$. Given the significant two-way interactions involving condition × age group and measure × age group, as well as the focus of the current work being on effects on each measure in each condition, we next examine results for each condition and measure separately and present those results in Fig. 3, following our pre-registration.

4.3.1. Gender condition

On the *preferences* measure, replicating the results in Study 2, children had a stronger preference for their gender ingroup than their minimal ingroup. They preferred their gender ingroup to their minimal ingroup on 63 % of all trials, which was 2.58 times more frequently than would be expected by chance, 95 % CI = [1.10, 6.01], $\beta = -0.95$, $SE = 0.43$, $p = .03$. As shown in Fig. 3, this effect appeared to be particularly salient in older children ($OR = 5.55$, 95 % CI = [1.61, 19.18], $\beta = -1.71$, $SE = 0.63$, $p = .007$), but the effect of age group was only marginally significant ($\beta = -1.50$, $SE = 0.83$, $p = .07$). On the *generalizations* measure, in contrast with Study 2 where we used novel properties (in third-party contexts), here participants showed a marginally significant tendency to expect their own gender ingroup members to share familiar properties with them (e.g., liking the same animals as them) on 60 % of the trials, 1.88 times more frequently than chance expectations, 95 % CI = [0.98, 3.62], $\beta = -0.63$, $SE = 0.33$, $p = .06$. There was a significant effect of age group ($\beta = -2.19$, $SE = 0.65$, $p < .001$): 6- and 7-year-olds

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[2] There was an unexpected effect of testing location on the generalizations measure in the gender condition ($p = .01$): the reported pattern was mainly driven by participants tested in the lab. Since this effect only emerged for this measure in this condition, we did not discuss it further.
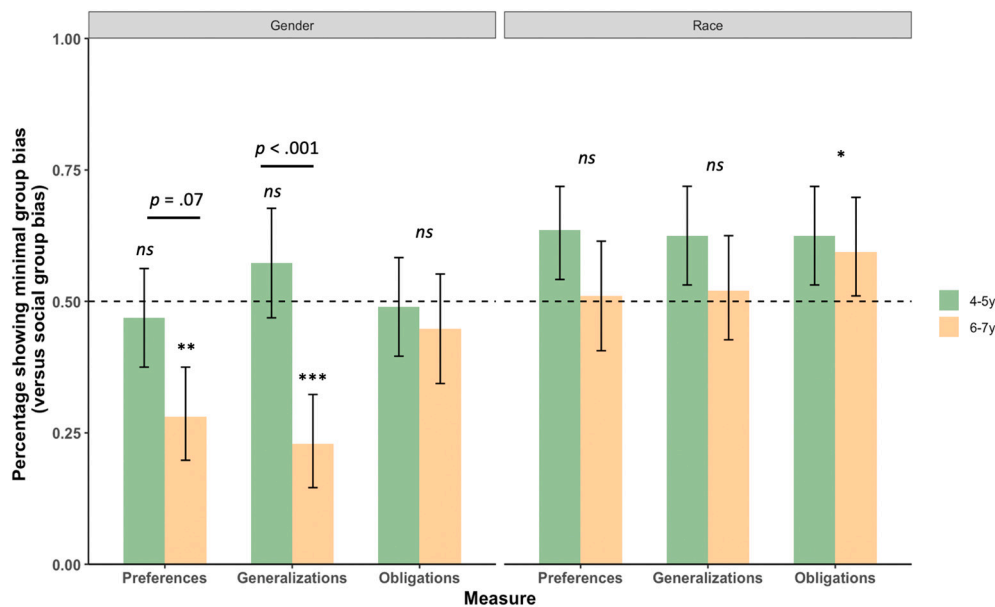
Fig. 3. Percentage showing minimal group bias (versus real social-group bias) across age groups and measures by conditions in Study 3.

made gender ingroup generalizations ($OR = 5.73$, 95 % CI = [2.22, 14.79], $\beta = -1.75$, $SE = 0.48$, $p < .001$) while younger children did not ($p = .28$). The type of property (e.g. liking the same snacks or animals) did not affect children's responses to this measure here or in the race condition. On the *obligations* measure, overall participants did not display a significant bias ($p = .49$); they showed gender ingroup bias on 53 % of the trials (i.e., expecting prosocial behaviors to happen within gender and antisocial behaviors to happen between genders). The main effects of age group and valence were both not significant ($ps > .30$); however, consistent with the results in Study 2, there was a significant interaction between age group and valence, $\beta = -1.90$, $SE = 0.71$, $p = .007$, driven by 4- and 5-year-olds showing stronger minimal group biases on prosocial trials as compared to antisocial trials ($OR = 3.75$, 95 % CI = [1.38, 10.20], $\beta = 1.32$, $SE = 0.51$, $p = .01$); while 6- and 7-year-olds did not show an effect of valence ($p = .22$).

4.3.2. Race condition

On *preferences* and *generalizations* measures, as in Study 2, children did not show a stronger bias for race ingroup or minimal ingroup: they preferred their minimal ingroup members on 57 % of trials ($p = .11$) and expected their minimal ingroup members to share their properties on 57 % of the trials ($p = .11$). On the *obligations* measure, however, in the first-party context here children displayed a significant minimal group bias (expecting prosocial behaviors from their minimal ingroups and anti-social behaviors from their minimal outgroups). Here children showed minimal group bias on 61 % of trials, 1.91 times more likely than they did otherwise, 95 % CI = [1.09, 3.33], $\beta = 0.64$, $SE = 0.29$, $p = .02$. This effect was mostly driven by the prosocial trials (the effect of valence: $OR = 2.33$, 95 % CI = [1.12, 4.85], $\beta = 0.85$, $SE = 0.37$, $p = .02$). Children expected more prosocial behaviors from their minimal ingroup members as compared to their race ingroup members ($OR = 3.01$, 95 % CI = [1.45, 6.27], $\beta = 1.10$, $SE = 0.37$, $p = .003$), but they did not show significant tendencies towards either direction in terms of antisocial behaviors ($p = .46$). Age effects on all three measures were not significant ($ps > .17$).

4.4. Discussion

These results replicated and extended the main findings of Study 2 using simplified measures. Overall, we found stronger gender effects than minimal group effects, and some hints of stronger minimal group

effects than race effects. In terms of preference, as in Study 2, children (at least by age 6) preferred their gender ingroup over their minimal ingroup. In contrast, they did not show any tendency to prefer race ingroup members over minimal ingroup members.

Our generalizations measure involved familiar properties in Study 3, and we found that children (at least by age 6) expected gender ingroup members but not minimal ingroup members to share their familiar properties. This supports the view as discussed in Study 2, that children might see a *novel* category like the minimal group as a more likely platform for generalizing *novel* properties, but they view a more familiar category like gender as a more reliable basis for generalizing *familiar* properties. As for the race condition, again children did not expect race ingroup members to be more likely than minimal ingroup members to share their properties.

A similar overall trend of the relatively weaker effect of race than minimal groups also appeared on the obligations measure. With the simplified, first-party measure children still did not show an overall tendency to treat either gender or the minimal group as more indicative of moral obligations, but they regarded the minimal group as more indicative than race when reasoning about moral behaviors towards themselves. Finding that the effect of minimal groups were either stronger than or similar to those of race support the hypothesis that race is a reversible byproduct in detecting coalitional alliances and thus can be erased if there is another strong and salient predictor of social alliance available in the local context (Kurzban et al., 2001). These findings also speak to the potential effectiveness of anti-racism interventions, especially when targeting young children, which we discuss in more detail in the General discussion.

5. General discussion

Three studies explored the relative strengths of minimal group membership and real-world social group memberships in influencing children's intergroup thinking. Consistent with past work, we found that merely belonging to an arbitrary group is sufficient to elicit group preference and the expectation of moral obligations in children (for a review, see Dunham, 2018). The novel contribution of the current work is that we directly pitted the minimal group against salient real-world groups (gender and race). We found that the relative strengths of min-imal group effects differed depending on the social category it was compared to as well as the domain of judgment, but gender and race

group memberships did not override minimal group in all cases. By age 6, children *preferred* gender ingroup members to minimal ingroup members and also viewed their gender ingroups as *more* likely to share *familiar* properties of themselves (e.g., liking the same snacks as them) than their minimal ingroups. At the same time, they did not differentiate race ingroup members from minimal ingroup members on these domains of judgments. In terms of moral obligations (e.g., helping or hitting them), children by age 4 considered the minimal group membership as a stronger basis for making coalitional inferences than race (in first-party reasoning). These findings inform several aspects of children's basic tendencies for group affiliation, the topic to which we now turn.

5.1. "Mere membership": an early-emerging generic representation for social groups

Together with results from previous research (e.g., Baron & Dunham, 2015; Dunham et al., 2011; Dunham & Emory, 2014; Yang & Dunham, 2019a), our finding of ingroup favoritism in 4- to 7-year-olds in Study 1 suggests the "mere membership" effect has early developmental roots (Dunham, 2018). New to the current work, we also found that the nature of the group plays a role in children's ingroup favoritism when different groups are pitted against each other. The preference for minimal groups were not always stronger than preference for real-world groups: Studies 2 and 3 also found that ingroup favoritism for gender was stronger than those for minimal groups (at least by age 6). These results are consistent with the contention (Cosmides et al., 2003; Shutts et al., 2010) that even among salient social categories that children have copious experiences with, gender may be a more prioritized or salient category. At the same time, the fact that we did not see children prefer race ingroups over minimal groups in Studies 2 and 3 further suggests that minimal group effects may not only be a generalization based on real group memberships. Instead, it might reflect an early-emerging generic representation for groups per se, which is on a par with, or even the initial basis of, some other group representations.

While most existing research on minimal group effects has focused on children's ingroup favoritism (i.e., preference for ingroup members, discussed above), our study also explored the effects of minimal groups compared to real groups in terms of children's naïve theories. We found that by ages 6 or 7, children used minimal group memberships to predict moral actions, but they did not use them to predict shared unobserved novel properties. This fits with the proposal that children are more likely to view social categories as markers of moral obligations via a coalitional interpretation of the groups than as deeply similar kinds, as might follow from considering them by analogy to natural kinds (Rhodes, 2012). Moreover, children predicted moral obligations based more on the minimal group than on race (in first-party cases). The relatively weaker effect of race somewhat aligns with past studies with adults that show that race are not perceived as unified or inferentially rich, especially compared to other categories that have common goals (e.g., sports teams, members of an orchestra, labor union memberships; Lickel et al., 2000). Our findings also provide direct evidence that children think minimal group membership is more meaningful than race membership in marking moral obligations. We also note an interaction between age group and moral valence that appeared in two studies: 4- and 5-year-olds showed a stronger minimal group bias (over gender bias) in their reasoning about prosocial behaviors than about antisocial behaviors, while 6- and 7-year-olds did not show this difference. Though the specific tasks differ, this age pattern is consistent with results in children's allocations of positive vs. negative resources in an intergroup context (e.g., Böhm & Buttelmann, 2017; Buttelmann & Böhm, 2014); future studies can explore these potential cognitive mechanisms further.

5.2. Limitations and future directions

We acknowledge several limitations of the present work. First, as

noted above, in several cases our primary findings consistent of null results, i.e. when we directly pitted minimal groups against gender or race we found responses indistinguishable from chance responding. Given that gender and race are both salient social categories that children detect early in life (e.g., Bar-Haim et al., 2006; Kelly et al., 2005; Quinn et al., 2002; Weikum et al., 2007) and show robust ingroup biases for (e.g., Kinzler et al., 2007), and that children also show such biased with respect to minimal groups (e.g., Baron & Dunham, 2015; Dunham et al., 2011), these findings suggest that the minimal group effect is of comparable magnitude to biases with respect to real groups, at least when they are directly pitted against each other in the manner we did here. Importantly, the findings across two studies that race never showed a stronger effect when contrasting with the minimal group offer helpful insights in anti-racism interventions. For example, we could potentially promote interracial friendships by putting children from diverse racial and ethnic backgrounds in the same minimal group. As children pay attention to their minimal group membership to the same if not greater extent than race, such interventions may help create positive cross-race experiences from early in the preschool years. Of course, null results are inherently difficult to interpret, but the broader pattern of results does suggest that children were sensitive to the grouping dimensions we presented. Additionally, it is an open question how other types of social groups (e.g., sports teams, kindergarten classrooms) compare with minimal groups. The current studies only focused on gender and race, two real-world social categories that are frequently thought of as biological and essentialized. Future work could fruitfully assess attitudes towards different target groups (e.g., non-natural groups like sports teams), and also assess each target group separately and compare them in that manner.

Another important limitation concerns the difficulty of equating the salience of the different groups we employed. Most notably, our procedure involved explicitly categorizing children into minimal groups, which seems likely to amplify the salience of that categorization dimension in a way that does not have a reasonable analog with respect to race and gender. Thus, it is possible that, absent the grouping manipulation, the relative salience of the different categories we investigated could differ. That said, measuring and equating the salience of the different groups employed is challenging. Gender and race are already salient social categories that children readily and perhaps even automatically attend to (e.g., Bennett & Sani, 2003; Dunham et al., 2011, 2013; Quinn et al., 2002; Weisman et al., 2015), whereas minimal groups are created immediately before testing (thus it is truly "minimal"). Therefore, by their very nature, gender and race may be more salient in children's mind than minimal group membership. It is also worth noting that we did not label any of the social categories during testing. Future work could increase and equate the salience of all the social categories in question, for example by explicitly categorizing individuals by both gender/race and minimal groups in the studies.

We also acknowledge that in the current work the participants were mostly White/European Americans, making our conclusions restricted within this particular racial and national group. It is crucial for future studies to diversify the samples and to explore whether children of different racial and national groups reason about social categories differently, and how such understandings intersect with children's own backgrounds (see Clark & Clark, 1947).

5.3. Conclusion

To conclude, across three studies we found that minimal groups do not produce minimal effects: from very early in life, children have basic tendencies to affiliate with minimal groups and use minimal group memberships to infer social interactions and moral obligations. Importantly, instead of treating all groups the same, children are sensitive to the nature of the groups. The effects of gender were stronger than the effects of minimal group membership at least on some domains, but the effects of minimal group membership were similar to or even stronger

than the effects of race. These findings suggest that minimal groups are plausible contributors to the early structure of children's reasoning and the processes by which social groups such as race acquire psychological salience.

Declaration of competing interest

The authors declare that they have no competing interests.

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