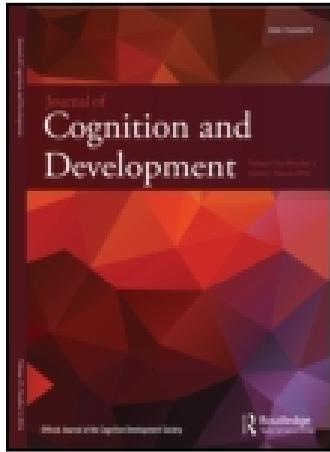


This article was downloaded by: [The University of British Columbia]

On: 15 August 2014, At: 22:28

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Journal of Cognition and Development

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/hjcd20>

### Constraints on the Acquisition of Social Category Concepts

Andrew Scott Baron <sup>a</sup>, Yarrow Dunham <sup>b</sup>, Mahzarin Banaji <sup>c</sup> & Susan Carey <sup>c</sup>

<sup>a</sup> University of British Columbia, Canada

<sup>b</sup> Princeton University

<sup>c</sup> Harvard University

Published online: 28 Feb 2014.

To cite this article: Andrew Scott Baron, Yarrow Dunham, Mahzarin Banaji & Susan Carey (2014) Constraints on the Acquisition of Social Category Concepts, *Journal of Cognition and Development*, 15:2, 238-268, DOI: [10.1080/15248372.2012.742902](https://doi.org/10.1080/15248372.2012.742902)

To link to this article: <http://dx.doi.org/10.1080/15248372.2012.742902>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

# Constraints on the Acquisition of Social Category Concepts

Andrew Scott Baron

*University of British Columbia, Canada*

Yarrow Dunham

*Princeton University*

Mahzarin Banaji and Susan Carey

*Harvard University*

Determining which dimensions of social classification are culturally significant is a developmental challenge. Some suggest this is accomplished by differentially privileging intrinsic visual cues over nonintrinsic cues (Atran, 1990; Gil-White, 2001), whereas others point to the role of noun labels as more general promoters of kind-based reasoning (Bigler & Liben, 2007; Gelman, 2003). A novel groups procedure was employed to examine the independent effects of noun labels and visual cues on social categorization. Experiment 1 demonstrated that in the absence of a visual cue, a noun label supported social categorization among 4-year-olds and 7-year-olds. Experiments 2 and 3 demonstrated that children and adults fail to differentiate between intrinsic and nonintrinsic visual cues to category membership, suggesting that this distinction is not central to the acquisition of social category concepts. Experiments 2 and 3 also showed that in the absence of a shared noun label, visual cues were not sufficient for younger children to form social categories. Experiment 4 ruled out a potential demand characteristic in the previous experiments. Together, these results reveal the primacy of verbal labels over visual cues for social categorization in young children and suggest a developmental change between ages 4 and 7 in the ability to construct new representations of social category concepts.

To successfully navigate the social world, children must reason about people's social group memberships. In doing so, they face two learning problems: They must determine which properties pick out social groups in their local milieu, and they must determine what properties are implied by social group membership. Each of these problems is far from trivial. Dimensions of social classification differ remarkably in their outward appearance, causal history, and the permeability of group boundaries. For example, membership in the category "blue-eyed people" is determined by a polygenetic trait affecting the amount of eumelanin in the iris. In contrast, membership in the category "Red Sox fan" is highly fluid and is determined by expressions of preference more directly under volitional control, such as how much an individual cares about the Red Sox winning, the clothes worn to a Red Sox game, and the amount of money paid to

watch the Red Sox in action. Similarly, the properties projected on the basis of social group membership (e.g., behaviors, dispositions, beliefs, preferences, language, friendship choices, rights, etc.) differ as widely as the dimensions of social classification (Ahn, Kim, Lassaline, & Dennis, 2000; Bloom, 1998; Hirschfeld, 1993, 1994, 1995b; Markman, 1989; Mervis & Rosch, 1981; Murphy, 2002; Rosch & Levitin, 2002). Despite these complexities, early in life, children reveal an exquisite ability to home in on culturally meaningful groupings such as gender, race, and language spoken, and they demonstrate an understanding that not all social categories project the same properties (Astuti, Solomon, & Carey, 2004; Bar-Haim, Ziv, Lamy, & Hodes, 2006; Diesendruck & Eldror, 2011; Fawcett & Markson, 2010a, 2010b; Gelman & Taylor, 2000; Heyman & Gelman, 2000a; Hirschfeld, 1994, 1995a, 1995b, 2001; Kinzler, Dupoux, & Spelke, 2007; Rhodes & Gelman, 2009; Shutts, Banaji, & Spelke, 2010; Shutts, Kinzler, McKee, & Spelke, 2009; Solomon, 2002).

Several theories attempt to account for how children create and deploy representations of new social categories. In a series of studies, Gelman and Heyman (Gelman & Heyman, 1999; Heyman & Gelman, 1999, 2000b) demonstrated that social categories marked with a noun label support significantly stronger inductive inferences than when labeled either with an adjective or a verbal predicate, suggesting that noun labeling promotes the deployment of representations of social categories and likely contributes to their initial acquisition. This claim is not specific to social category reasoning, as the propensity to treat nouns as picking out *kinds* is well documented across a variety of developmental domains (Markman, 1989; Waxman, 2010) and is even visible in 12-month-old infants' expectations about object identity (Xu, Cote, & Baker, 2005). Of course, even if labeling a category with a noun promotes inductive inference within both the social and nonsocial domains, it is still possible that other aspects of social categorization might diverge in interesting ways from categorization in other domains.

On this note, some have argued that young children assimilate social categories to biological ones, essentializing them as they do species kinds. For example, Medin and Atran (2004), Atran (1990), and Gil-White (2001) suggest that children essentialize some social categories by misapplying species-kind reasoning drawn from the biological domain (e.g., plants, animals) to the social domain (e.g., race, gender). This motivates the prediction that children might privilege properties that appear to have a biological basis (e.g., apparently intrinsic visual cues such as skin color) because these cues are suggestive of species differences. Although this specific claim is still untested, recent work has explored children's inferences about essentialized and nonessentialized categories while beginning to challenge the assumption that representations of social categories are derived from biological concepts (Diesendruck & Eldror, 2011). For example, Diesendruck and Eldror examined 4- to 6-year-olds' expectations about social groups and the property inductions licensed by shared group membership. They observed that children may privilege psychological properties and causal properties when making judgments about category members.

In contrast, Aboud (1988) has suggested that all salient perceptual cues to similarity (e.g., distinctive clothes, skin color, hair length, distinctive behaviors) that co-occur with group membership and thereby distinguish groups are likely to form a basis for social categorization. Drawing largely on the work of Piaget (1929), Aboud (1988) argues that domain-general cognitive faculties of logical reasoning underlie the construction of all categories and that qualitative changes in these reasoning abilities drive stage-like developmental changes in children's categorization skills, social and nonsocial alike. For younger children (e.g., 6 years of age and

younger), this entails a reliance on salient perceptual cues, suggesting that the earliest categories children acquire will likely be grounded in those that are marked by shared visual cues in particular (for a similar analysis of the role of perceptual salience, see Bigler & Liben, 2007). This view stands in contrast to the claim that intrinsic visual cues (and their implication of a difference in biological kind) are more salient when establishing representations of social categories. Further, this view stands in contrast to the noun-labeling hypothesis, which bestows little importance on visual properties to category membership because the inductive power of social categorization is derived from deeper representations of kinds supported by the presence of a common count noun label.

In one of the few studies to directly weigh in on these accounts, Diesendruck and haLevi (2006) explored the role of noun labeling as well as several dimensions of social categorization (e.g., shared personality, shared religion, shared physical appearance) in determining the properties projected by social categorization (e.g., preferences). Five-year-olds were introduced to pictures of two test individuals and were taught several unique properties about each individual (e.g., “This girl is religious. She is shy. This shy religious girl likes to flep. This girl is secular. She is friendly. This friendly secular girl likes to dax.”). Next, participants were introduced to a target individual and were told that this individual shares one property in common with each of the test characters (e.g., “This girl is secular like her. She is she shy like her.”), and then participants were asked which preference the target individual shared (e.g., “Do you think she likes to flep like her or dax like her?”). The dependent measure was the proportion of inferences participants drew based on shared social category membership (e.g., religion, gender) as compared with shared physical property (e.g., height) or psychological trait (e.g., shy). In two experiments, shared properties were marked visually and verbally. In two further experiments, verbal labels were contrasted with physical similarity.

Across these experiments, children drew more inductive inferences for labeled social categories than for groups that shared a common physical property or psychological trait (Diesendruck & haLevi, 2006; see also Hirschfeld, 1995b, for a similar observation). In other words, children were more likely to think that the target individual shared the same novel preference as the person who matched him/her in social category membership (e.g., religion, gender) than the person who shared a common physical or psychological trait. This pattern of results held constant even when visual cues to group membership were eliminated, dovetailing with findings from the broader categorization literature in which visual cues to similarity are not necessary for categorization, and supporting a privileged role for noun labels as compared with other bases of similarity (in this case, shared personality or physical traits; Gelman & Heyman, 1999; Heyman & Gelman, 1999, 2000b; Markman, 1989).

Most developmental studies of social categories focus on actual social groups well represented in children’s experience, and to which they know themselves to either belong or not (e.g., race in North America, Aboud, 1988; Bigler & Liben, 2007; Hirschfeld, 1994; Jews and Arabs in Israel, Diesendruck & haLevi, 2006). Although of course valuable, such research may obscure generalization about the general process of social category acquisition for at least two reasons. First, merely belonging to social groups—even previously unfamiliar ones—is enough to induce children, at least from the preschool years, to prefer “ingroups” on both explicit and implicit measures (Bigler, Jones, & Lobliner, 1997; Dunham, Baron, & Carey, 2011; Nesdale & Flessler, 2001; Patterson & Bigler, 2006). Thus, merely belonging to a group can shift children’s pattern of attention and inference, implying that results with familiar groups could depend on this form of

identification. Second, the focus on familiar, highly salient social groups raises the possibility that children paid attention to the social categories they did because they had learned that these social groups are supremely important in their cultural setting. More broadly, by early elementary school, children have knowledge of at least some of the stereotypes and consensus cultural evaluations of the groups that surround them (Cvencek, Greenwald, & Meltzoff, 2011; Cvencek, Meltzoff, & Greenwald, 2011; Dunham, Baron, & Banaji, 2008). This rich learning history makes it difficult to identify more general expectations about how groups function. Investigation of the psychological processes involved in the acquisition, representation, and deployment of social category concepts necessarily requires a focus on both the naturally occurring categories in the real world and novel categories created in the laboratory that can control for such variables as familiarity and group membership.

One powerful approach to studying children's initial intuitive expectations about groups is to focus on the acquisition of *novel* social categories. Because they have not previously been encountered, we can be sure that children's subsequent judgments are based on the specific information provided in the experimental setting. And because we can present children with scenarios in which they do not belong to the groups in question, we can also avoid the biasing effects of membership. This approach allows us to examine the abstract principles by which children create social categories in the first place. We here build on previous research using a novel groups procedure (e.g., Diesendruck & Eldror, 2011; Ford & Stangor, 1992; Gregg, Seibt, & Banaji, 2006; Levy, Stroessner, & Dweck, 1998), in which participants are introduced to previously unfamiliar social groups, taught some information about a few exemplars (e.g., evidence that they performed antisocial behavior), and then asked to make judgments (e.g., inferences, evaluations) about other members of the group. In the present study, we present stories about individuals who might be seen as members of the same social group, and we explore what cues to group membership promote social categorization. We illustrate our stories with pictures. To even further reduce the possibility that children would draw on preexisting knowledge or identify preferentially with one or the other group, the drawings depicted the individuals as nonhuman cartoon characters.

Within this framework, the present inquiry focuses on five questions. First, we examined whether the following cues were sufficient, in the absence of any shared perceptual features among category members, to promote the formation of a new social category among 4- and 7-year-olds: a noun label uniting two individuals who were always depicted together, engaging in coordinated antisocial acts. Second, we examined whether in the absence of a noun label, but in the presence of shared perceptual features, social categorization would emerge in the same vignettes. Third, we explored the hypothesis that children will differentially privilege intrinsic cues like skin color over nonintrinsic cues like clothing when forming representations of social groups. Fourth, we examined the additive effect of a noun label and a visual cue by asking whether noun labels lead to a closer focus on the type of visual cues that support social categorization. Finally, we examined whether evidence of social categorization in the first three experiments can be explained in terms of a simple correlation among coordinated behavior between individuals who share a noun label and visual properties, when that shared behavior had no socially relevant content.

We attempted to ensure that our experiments test the formation of categories that are *social*. They involve categories of people, or at the very least, agentive individuals with human-like properties. The information we present involves a series of social interactions among individual group members where individuals collectively and collaboratively engage in antisocial behavior.

Third, the dependent measures we employ involve expectations regarding dispositions to act antisocially or prosocially, as well as judgments about the friendship potential of members of the different groups. In sum, these studies investigate whether variation in the features defining groups (noun labels, various visible cues, nature of coordinated action) affects children's tendency to form inductively and affectively rich social categories.

## EXPERIMENT 1

Experiment 1 directly examined whether, in the absence of a shared visual cue to group membership, children could use a noun label correlated with individuals engaging in antisocial behavior to establish a representation of a social category. Children heard a story about two individuals labeled as Lups who engaged in antisocial behaviors, while several individuals labeled as Nifs engaged in neutral to mildly positive behaviors. To ensure that children would not identify with the target individuals and could bring no prior knowledge of social groups to bear on the task, the Lups and Nifs were not pictured as actual people but rather as cartoon figures. Despite this, the basis of categorization picked out by the label was clearly social: Each Lup repeatedly engaged in antisocial acts in coordination with another individual bearing the same noun label, Nifs engaged in neutral acts, and many intergroup social interactions were depicted. Our measures of social categorization were predictions about whether new Lups and Nifs not depicted in the story would engage in novel positive and negative social behaviors, as well as relative friendship choices among Lups and Nifs also not presented earlier in the story.

Children are provided with two bases for establishing a representation of a social category: a shared noun label and evidence of socially relevant behavioral consistency among individuals. Although individual characters differed from one another visually (e.g., hair style, shape of facial features, presence of freckles, etc.), this individual variation did not vary systematically with group membership. Specifically, individuals only differed in the noun label used to refer to them and by the tendency to perform antisocial acts. Thus, no physical differences between individuals could serve as a cue to group membership.

In addition to supporting inductive inferences about social behavior, social categories also support intergroup preferences. These preferences often serve as crucial mediators of intergroup behavior including predicting friendship choices among children and predicting hiring decisions among adults. As such, we also measured children's preference for the two novel groups. If categorization of novel social groups requires clear visual markers to differentiate categories, we would not expect children to generalize novel antisocial behaviors to new members of the group portrayed negatively in the story (the Lups). In addition, they should not generalize more prosocial behaviors toward members of the other group (the Nifs) nor should they prefer members of the other group (the Nifs) as potential friends.

## Method

### *Participants*

Thirty-five 4-year olds ( $M_{\text{age}} = 4;5$ ; 18 females) and thirty 7-year olds ( $M_{\text{age}} = 7;7$ ; 15 females) were recruited. Child participants were recruited from the community and were tested either in

our laboratory or at local day cares, preschools, afterschool programs, and museums. A legal guardian provided informed consent for all children.

### *Procedure*

All participants were tested individually and worked one-on-one with an experimenter who read aloud the instructions and who recorded their responses on a laptop computer. Using a repeated-measures design to control for individual baseline differences, participants were first asked to make attributions of positive and negative social behaviors to novel agents. Subsequently, participants were asked to report their preference for individuals from both groups. During this pretest, the characters were labeled as “this person”; however, these novel agents would eventually be labeled as Lups and Nifs during the posttest assessments. Next, participants heard a story in which individuals were labeled either as a Lup or as a Nif and learned that individual Lups behaved in an antisocial manner. The story involved multiple vignettes involving the same two people from each group. Next, participants were presented with the same attribution and preference questions from the pretest; however, this time, the targets were labeled as either a Lup or as a Nif. The specific individuals who appeared in the story were not included in the set of generalization and preference questions, thereby ensuring that any systematic judgments reflected categorical judgments about the Lups and Nifs and not about specific individual Lups and Nifs.<sup>1</sup> Further, each individual in the pretest and posttest measures was never consistently linked with either a positive or negative behavior. The story provides information about the behavioral tendencies of specific individuals who share a common noun label, and the dependent measures require participants to use the noun label to facilitate categorization of new individuals and subsequent category-dependent inferences (e.g., that Lups, more so than Nifs, are likely to engage in novel antisocial acts, are less likely to engage in prosocial behavior, and are less desirable as friends).

### *Pretest Measures*

***Attribution task.*** Participants first began by responding to eight ambiguous situations each involving two novel actors. Four of these situations involved a negative social behavior (e.g., someone knocked someone else over, someone caused a car crash), and four involved a positive social behavior (e.g., helping a friend at school, cleaning up spilled milk). See Appendix A for a full list of these questions. For each question, participants saw two cartoon drawings of unique people-like agents side by side (had eyes, ears, mouth, nose, arms, feet and were said to have engaged in people-typical activities such as skateboarding, drinking milk, writing, etc.). Participants were then instructed to “Point to the person who did the thing I tell you about.” The experimenter entered each response into the computer. See Figure 1 for example illustrations of these characters.

***Group preference task.*** Following the Attribution Task, participants viewed two novel individuals side by side and were asked to indicate which person they liked more. There were a total of eight such trials involving different individual exemplars not seen previously.

<sup>1</sup>Pilot data showed that at each age, participants correctly identified that the exemplars in each measure were not the specific individuals shown in the story manipulation but rather were novel members of the category (>90%).

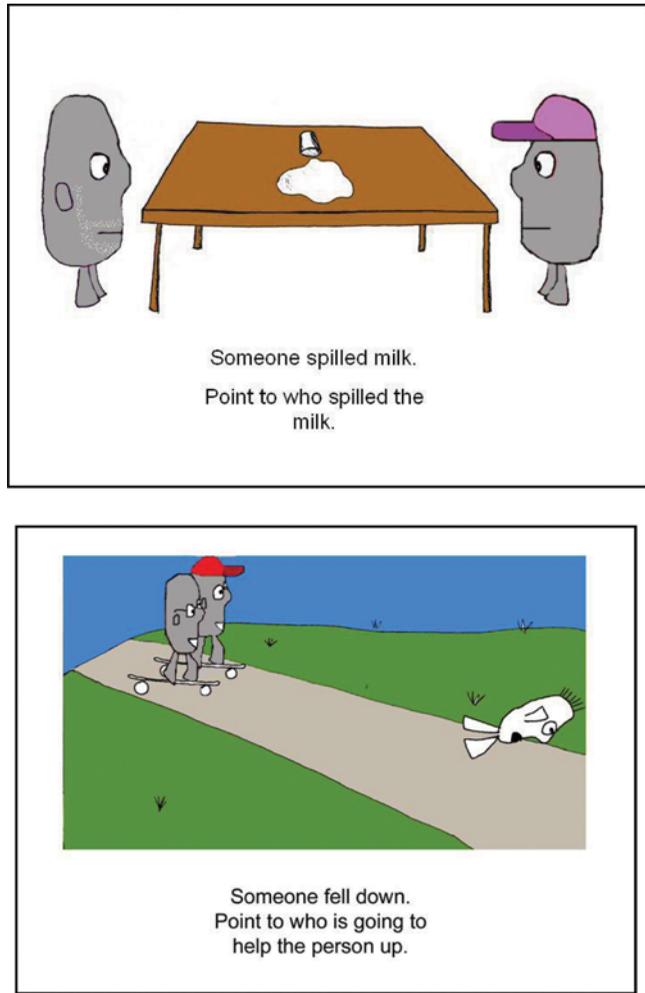


FIGURE 1 Sample illustrations that accompanied the Generalization Task questions during the pretest and posttest assessments in Experiment 1. (Color figure available online.)

### *Story Manipulation*

Following the Group Preference Task, the experimenter read a short story about two novel social groups. Individuals in the story differed systematically in the noun label used to refer to them, either as a Lup or as a Nif, and in the type of behavior performed (either antisocial acts or neutral to mildly positive acts). During the story, participants observed two individuals who shared a common label (the Lups) engage together in antisocial behaviors (e.g., not sharing, stealing a pie, tearing up someone’s artwork). Importantly, these two individuals were always the transgressors, and when there was a known victim, it was a member of the other group

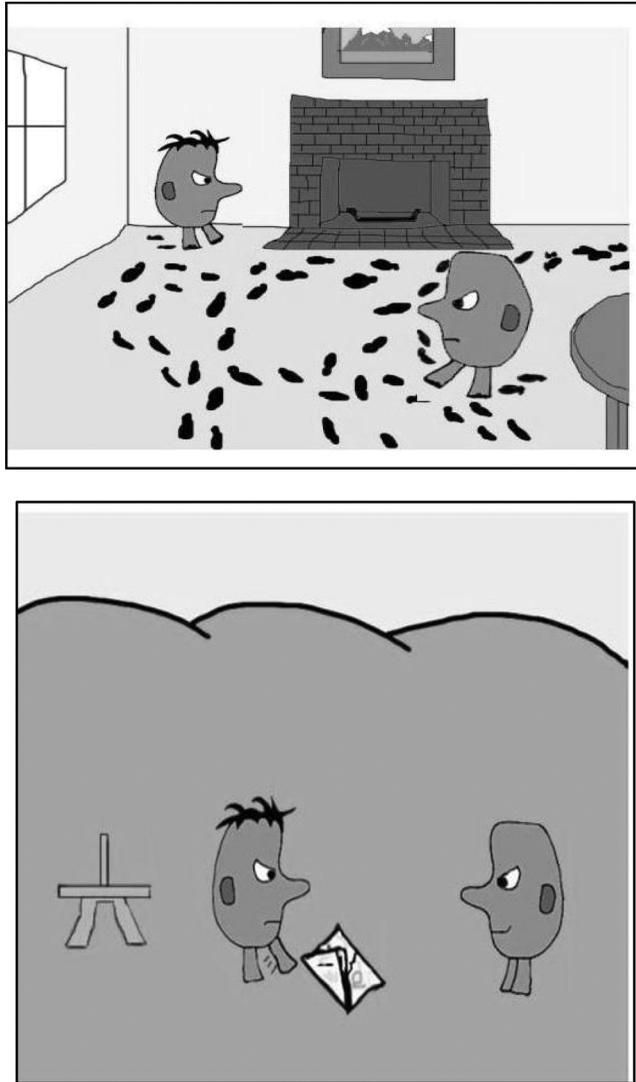


FIGURE 2 Sample illustrations that accompanied the story manipulation in Experiment 1. Here, members from one group engage in two negative behaviors—making a mess of a house and tearing up a painting.

(the Nifs).<sup>2</sup> See Appendix B for the full text of the story and see Figure 2 for example illustrations that accompanied the story text. Whereas the text of the story refers to the two main characters as both “these Lups” and “the Lups,” the full context of the story strongly implies that these phrases refer to the two particular individuals displayed on the screen before them as

<sup>2</sup>Pretesting revealed no baseline difference in the evaluation of individuals labeled as Lups or as Nifs; therefore, we decided to have one group label (the Lups) always associated with the transgressors in the story.

opposed to a generic interpretation referring to all Lups; indeed, each time the experimenter referenced either “these Lups” or “the Lups,” she pointed to both of the Lups on the screen.

### *Posttest Measures*

Next, participants responded to the same Attribution Task questions followed by the Group Preference Task questions as described earlier. The questions within each task appeared in a random order, but task order was fixed. This time, each individual was labeled with a noun label (either as a Lup or as a Nif). For example, on a particular trial of the Attribution Task, a participant would be asked, “Who stole some money? This Lup or this Nif?” and participants responded by pointing to one of the two individuals on the monitor. Importantly, children’s judgments were elicited concerning the likelihood that new members of both groups would engage in new behaviors not previously depicted in the story, and they were asked their friendship preferences among a new Lup and a new Nif not seen before. In this way, the inductive potential of the groups was measured. In each case, participants had to decide to select one Lup or one Nif.

## Results

All participants completed the experiment. Preliminary analyses revealed no effect of participants’ gender at any age, and therefore, subsequent analyses collapsed across this factor. For the Attribution Task, two percentages were calculated: one for the frequency with which bad behaviors were attributed to the group portrayed negatively (out of four possible trials) and one for the frequency with which good behaviors were attributed to the group portrayed negatively (out of four possible trials). For the Group Preference Task, one percentage was calculated for the frequency with which a member from the group portrayed negatively was chosen over a member of the group not portrayed negatively (out of eight possible trials).

For each task, separate percentages were calculated for pretest and posttest responses. During the pretest measures, no visual cues or labels could be used to identify the Lups and Nifs. Thus, pretest responses were linked to specific individuals who would eventually be paired with a particular group label at posttest, allowing us to calculate the effect of being part of either group. Across all age groups and tasks, the pretest percentages did not differ from chance (50%). Difference scores are reported in this section to convey the magnitude and direction of the change in attributions and preference following the story manipulation; a summary of results is presented in Figure 3. For ease of graphical presentation only, posttest percentages are displayed. Finally, for the analyses reported here, we perform separate analyses of variance (ANOVAs) for the generalization of negative behaviors, generalization of positive behaviors, and reported group preference. Research has suggested that positive and negative intergroup evaluations are conceptually independent and follow different developmental trajectories (Aboud, 2003), leading us to make planned comparisons between these individual measures of generalization and preference.

### *Negative Attributions*

Observing two individuals engaging in negative behavior and labeled with the same noun was sufficient to lead children of both ages to project the tendency to perform antisocial acts

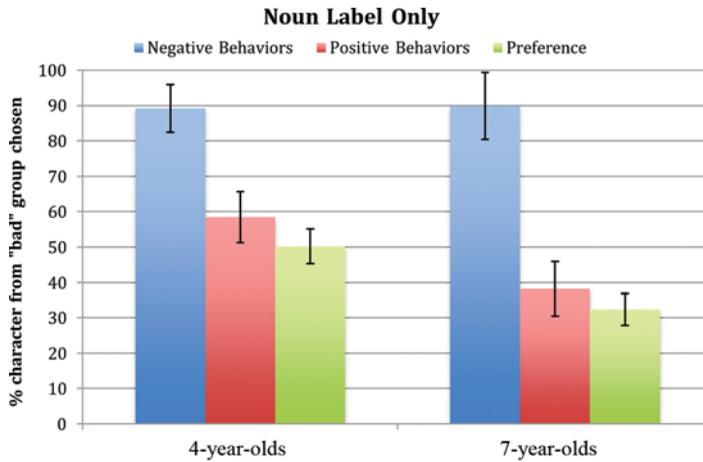


FIGURE 3 Mean percentage of negative and positive behaviors attributed to characters from the negatively portrayed group as well as reported group preference for 4- and 7-year-old participants (posttest means, Experiment 1). (Color figure available online.)

to new individuals bearing the same category label. Participants in both age groups generalized more antisocial behaviors to the “bad” group following the story manipulation (4-year-olds,  $M_{\text{diff}} = 30\%$ ; and for 7-year-olds,  $M_{\text{diff}} = 50\%$ ). A  $2 \times 2$  (test time: pretest and posttest generalization of negative behaviors; age group: 4-year-olds and 7-year-olds) repeated-measures ANOVA confirmed this and revealed a significant main effect of test time,  $F(1, 63) = 35.02$ ,  $p < .05$ ,  $\eta_p^2 = 0.36$ , such that the rate of negative generalizations to new members of the “bad” group (the Lups) was higher after the story manipulation. No main effect of age or a test time  $\times$  age group interaction was observed (all  $ps > .1$ ).

### *Positive Attributions*

Following the story manipulation, participants were *less* likely to generalize positive behaviors to the group portrayed negatively (the Lups; 4-year-olds,  $M_{\text{diff}} = -11.5\%$ ; 7-year-olds,  $M_{\text{diff}} = -26.5\%$ ). As with the attribution of negative behaviors, a  $2 \times 2$  (test time: pretest and posttest generalization of positive behaviors; age group: 4-year-olds and 7-year-olds) repeated-measures ANOVA revealed a main effect of test time,  $F(1, 63) = 8.39$ ,  $p < .01$ ,  $\eta_p^2 = 0.12$ . Similarly, no main effect of age group or a test time  $\times$  age group interaction was detected (all  $ps > .1$ ). However, it is worth noting that as a group, 4-year-olds did not reveal a significant tendency to generalize fewer positive behaviors to the Lups, compared with pretest; the  $-11.5\%$  change did not differ significantly from 0,  $t(34) = -1.02$ ,  $p > .3$ . In contrast, 7-year-olds were significantly more likely to generalize fewer positive behaviors to the Lups on the posttest,  $t(29) = -2.98$ ,  $p < .01$ .

### *Group Preference*

A  $2 \times 2$  (test time: pretest and posttest reported group preference; age group: 4-year-olds and 7-year-olds) repeated-measures ANOVA revealed no main effect for change in reported

preference for either group following the story manipulation (4-year-olds,  $M_{\text{diff}} = 6\%$ ; 7-year-olds,  $M_{\text{diff}} = -14.2\%$ ). However, a main effect of age group was observed,  $F(1, 63) = 4.1$ ,  $p < .05$ ,  $\eta_p^2 = 0.06$ , as was a test time  $\times$  age group interaction,  $F(2, 63) = 5.25$ ,  $p < .05$ ,  $\eta_p^2 = 0.08$ . Seven-year-olds,  $t(29) = 2.39$ ,  $p < .05$ , but not 4-year-olds,  $t(34) = -0.95$ ,  $p > .1$ , showed a significant decrease in their reported preference for the Lups, the group described negatively in the story.

## Discussion

Converging with earlier findings with familiar social categories as well as for nonsocial categories (Diesendruck & haLevi, 2006; Gelman & Markman, 1986, 1987; Markman, 1989), these data demonstrate that even in the complete absence of visual cues to category membership, children can successfully establish a representation of a social category that supports projection of socially relevant properties to newly encountered members of the group. In this study, evidence of members of one group, the Lups, behaving antisocially together covaried with a noun label for that group. This coupling was sufficient to lead children to make the induction that other individuals who shared the same category label would likely behave antisocially. For one dependent measure, the generalization of novel antisocial acts, the basis of generalization is the same type of behavior previously observed during the story manipulation. Generalizing negative behaviors to similarly labeled individuals requires seeing different antisocial, negatively valenced acts to be categorically similar to each other and to be predicted by the behavior of other individuals from the same social groups. Both the younger and older children made these generalizations. Moreover, older children made an additional inference that new Lups would also be less likely to engage in prosocial behavior and were less desirable friends than new Nifs. By contrast, our younger participants failed to establish as robust a group-level representation. Unlike 7-year-olds, they failed to judge that the Lups were less likely to exhibit prosocial behaviors than were the Nifs, and they failed to form a consistent group-level preference, though they did clearly expect more negative behaviors from the Lups than from the Nifs. This pattern may have emerged because the explicit information contained in the story involved antisocial behaviors; integrating such behavioral information with inferences about prosocial behaviors and reported preference judgments may require a subsequent inferential step not made automatically by 4-year-olds.

These results replicate a now well-established finding concerning the inductive power of noun labels in a completely novel paradigm and demonstrate that prior results involving familiar social groups (e.g., ethnicity, religion, race, gender) are not entirely due to the influence of group membership or cultural salience. The effects of labeling reported here extend to judgments of prosocial and antisocial behavior as well as to judgments of intergroup preference, at least for the 7-year-olds as these children made judgments about behaviors and friendship choices that went beyond the specific pattern of behavior observed in the story. These inferences are deployed over representations of the novel categories of Lups and Nifs, demonstrating that this novel groups procedure can be used to study young children's *formation* of social categories that support socially relevant inductive inferences. We now turn to the role that visual cues to group membership may play in establishing representations of new social categories.

## EXPERIMENT 2

Although Experiment 1 demonstrates that a visual cue to category membership is not necessary to facilitate categorization at these ages, it does not bear on whether certain visual cues in the absence of a shared noun label might promote social categorization. No previous studies have addressed this question, but cognitive developmental theory (Aboud, 1988) predicts that children of all ages should be able to categorize on the basis of shared visual features. Indeed, Aboud's (1988) theory holds that this is the *primary* basis for young children's social categorization. Other theorists have suggested that children might privilege apparently intrinsic visual cues to category membership over apparently nonintrinsic visual cues (Atran, 1990; Gil-White, 2001). Thus, in exploring the role of visual marking as a determinant of social category formation, we varied the type of cue to category membership between an intrinsic cue (skin color) and a nonintrinsic cue (hat color) in Experiment 2. Finally, adults were examined in case the privileging of intrinsic cues emerged later than age 7.

### Method

#### *Participants*

Eighty-eight 4-year-olds ( $M_{\text{age}} = 4;5$ ; 38 females), sixty-five 7-year-olds ( $M_{\text{age}} = 7;7$ ; 32 females), and 53 adults<sup>3</sup> ( $M_{\text{age}} = 20;2$ ; 28 females) participated in Experiment 2. Child participants were recruited and were tested as in Experiment 1. Adults received course credit in an Introductory Psychology class or received monetary reimbursement for their participation. Adult participants provided their own consent.

#### *Procedure*

The procedure for Experiment 2 was identical to the procedure outlined for Experiment 1 except for two critical differences. First, at no time was a count noun label used to refer to the different individuals. Thus, no character was labeled as a Lup or as a Nif in this experiment. Instead, each individual during the story manipulation and during the posttest questions (Attribution Task and Group Preference Task) received a unique proper name (during the pretest measures, each person was referred to as "this person"). Thus, during the story manipulation, participants observed two individuals (Dave and Sarah) engage together in a series of antisocial behaviors. During the posttest generalization and group preference measures, participants were introduced to new individuals marked by new proper names—that is, names not used previously in the experiment. For child participants, the experimenter labeled each individual with a distinct proper name. For adult participants, each name was printed below the picture of the character on the computer monitor.

The second change concerned the presence of a visual cue to category membership. Participants were randomly assigned to either the Intrinsic Property condition (skin color) or to

<sup>3</sup>Adult participants completed the experiment in a private cubicle, read the instructions to themselves, and entered their own responses on a desktop computer. An experimenter was present to answer questions if needed.

the Nonintrinsic Property condition (hat color). For example, the two characters who always together acted antisocially might both be red, or might both have red hats. For each question on the Attribution Task and Group Preference Task, participants saw two drawings of unique cartoon agents, where one agent had red-colored skin and the other had purple-colored skin (Intrinsic Property condition). In the Nonintrinsic Property condition, the characters shared the same skin color (grey) as in Experiment 1 but differed in the color hat they wore (e.g., either a red-colored hat or a purple-colored hat).<sup>4</sup>

### *Measures*

Experiment 2 employed the same exact measures reported in Experiment 1. The results, plotted as in Experiment 1, are shown on Figure 4.

### **Results**

Eleven participants failed to complete the experiment (six 4-year-olds and five 7-year-olds voluntarily decided to end early) and were not included in the analyses. Preliminary analyses revealed no baseline color preferences for any age group in either condition; therefore, subsequent analyses collapsed across this variable. Finally, the data were prepared and analyzed following the same procedures outlined in Experiment 1.

### *Negative Attributions*

At no age did participants differentiate between intrinsic and nonintrinsic cues to category membership with respect to their pattern of generalization. A  $2 \times 2 \times 3$  (test time: pretest and posttest generalization of negative behaviors; condition: intrinsic property and nonintrinsic property; age group: 4-year-olds, 7-year-olds, and adults) ANOVA with repeated measures on the first variable did not reveal a main effect of condition ( $p > .1$ ). However, a main effect of test time was observed,  $F(1, 189) = 27.16$ ,  $p < .01$ ,  $\eta_p^2 = 0.13$ , such that participants were significantly more likely to generalize negative behaviors to the group (marked by either shared skin color or hat color) that was portrayed negatively following the story manipulation ( $M_{\text{diff}} = 14\%$ ). Although no main effect of age group was observed, a test time  $\times$  age group interaction was found,  $F(2, 189) = 9.34$ ,  $p < .01$ ,  $\eta_p^2 = 0.09$ , with older participants showing a more pronounced differentiation of pretest and posttest attributions. A post-hoc paired-samples  $t$ -test revealed that only 7-year-olds ( $M_{\text{diff}} = 9\%$ ) and adults ( $M_{\text{diff}} = 28\%$ ) made more negative attributions to the group portrayed negatively than they had in the pretest,  $t(59) = -3.43$ ,  $p < .01$ , and  $t(52) = -4.88$ ,  $p < .01$ , respectively. Contrary the predictions of cognitive developmental theory (Aboud, 1988), 4-year-olds did not spontaneously use a salient visual cue as a basis for fixing category membership and thus failed to generalize negative behaviors in a consistent manner ( $M_{\text{diff}} = 3\%$ ),  $t(81) = 0.50$ ,  $p > .6$ . Thus, children of this age were unable to use the correlation

<sup>4</sup>Pilot data confirmed that children of these ages interpreted skin color as an immutable property and hat color as a property under volitional control, suggesting that skin color, but not hat color, is viewed as an intrinsic property.

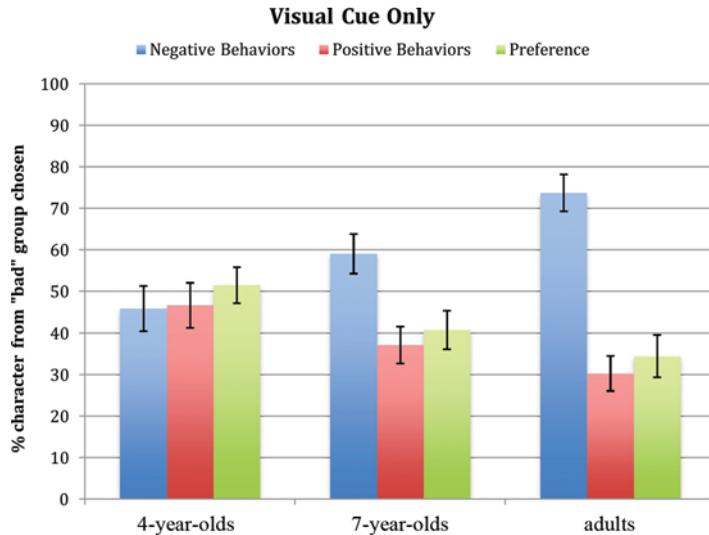


FIGURE 4 Mean percentage of negative and positive behaviors attributed to characters from the negatively portrayed group as well as reported group preference for 4-year-olds, 7-year-olds, and adult participants (posttest means, Experiment 2). Participants in the Intrinsic Property condition and in the Nonintrinsic Property condition are collapsed. (Color figure available online.)

between a visual cue to group membership and a common pattern of behavior among individuals present in the story to guide judgments about newly encountered individuals.

### *Positive Attributions*

A  $2 \times 2 \times 3$  (test time: pretest and posttest generalization of positive behaviors; condition: intrinsic property and nonintrinsic property; age group: 4-year-olds, 7-year-olds, and adults) ANOVA with repeated measures on the first variable found no main effect of condition ( $p > .1$ ). A main effect of test time emerged,  $F(1, 189) = 18.91, p < .01, \eta_p^2 = 0.09$ , such that after hearing one group portrayed negatively in the story, participants were less likely to attribute positive behaviors to new members of that group compared with their pretest attributions ( $M_{\text{diff}} = -9\%$ ). Although a main effect of age group was not observed, there was a significant test time  $\times$  age group interaction,  $F(2, 189) = 3.05, p = .05, \eta_p^2 = 0.03$ . Post-hoc paired-samples  $t$ -tests revealed that older participants (7-year-olds,  $M_{\text{diff}} = -10\%$ , and adults,  $M_{\text{diff}} = -14\%$ ) attributed fewer positive behaviors to the group portrayed negatively after the story,  $t(59) = 2.0, p = .05$ , and  $t(52) = 3.713, p < .05$ , respectively. Four-year-olds failed to adjust their pretest levels of positive evaluations of the group portrayed negatively ( $M_{\text{diff}} = -2\%, p > .1$ ). Adding to the finding that children of this age also failed to consistently generalize negative behaviors, it appears that a visually salient cue coupled with a coordinated pattern of behavior is not sufficient to enable 4-year-olds to establish a representation of a social category. However, by age 7, children are able to use such information to guide their reasoning about novel individuals.

### *Group Preference*

Consistent with the results on the Attribution Task, there were no effects involving the variable of cue type. A  $2 \times 2 \times 3$  (test time: pretest and posttest reported group preference; condition: intrinsic property and nonintrinsic property; age group: 4-year-olds, 7-year-olds, and adults) ANOVA with repeated measures on the first variable revealed no main effect of condition,  $F(1, 189) = 2.38$ ,  $p > .1$ , and no interactions involving this variable. A main effect of test time did emerge, such that participants reported a significant decrease in their preference for members of the group portrayed negatively in the story ( $M_{\text{diff}} = -3.5\%$ ),  $F(1, 189) = 11.71$ ,  $p < .01$ ,  $\eta_p^2 = 0.06$ . Although a main effect of age group was not detected,  $F(2, 189) = 1.70$ ,  $p > .1$ , a test time  $\times$  age group interaction was found,  $F(2, 189) = 5.07$ ,  $p < .01$ ,  $\eta_p^2 = 0.05$ . A post-hoc comparison revealed that only older participants (7-year-olds,  $M_{\text{diff}} = -6\%$ , and adults,  $M_{\text{diff}} = -9\%$ ) decreased their preference for the group portrayed negatively following the story manipulation,  $t(59) = 2.7$ ,  $p < .01$ , and  $t(52) = 2.20$ ,  $p < .05$ , respectively. Once again, hearing that two individuals (who shared the same skin color or hat color) repeatedly performed anti-social acts did not lead 4-year-olds to prefer individuals of a different skin or hat color as friends ( $M_{\text{diff}} = 5\%$ ,  $p > .8$ ).

### *Contrasting Labels and Visual Cues*

To directly examine the power of each cue type in establishing inductively rich representations of a social category, performance in Experiment 1 and Experiment 2 was contrasted for 4-year-olds and 7-year-olds. Because the distinction between an intrinsic and nonintrinsic visual cue was not observed on any of the dependent measures in Experiment 2, these cue types were collapsed for the purpose of the following analyses. A  $2 \times 2 \times 2$  (test time: pretest and posttest; category cue: label and visual; age group: 4-year-olds and 7-year-olds) ANOVA with repeated measures on the first variable was performed for negative attributions, positive attributions, and group preference. A main effect of category cue (Experiment 1: label; Experiment 2: visual) was observed for the attribution of negative behaviors ( $M_{\text{Exp1}} = 40\%$ ,  $M_{\text{Exp2}} = 6.36\%$ ),  $F(1, 203) = 28.5$ ,  $p < .01$ ,  $\eta_p^2 = 0.12$ , revealing that a noun label is more powerful than a visual cue in supporting category-based inferences. A main effect of age group was not observed, suggesting that labels are more powerful than visual cues for both 4-year-olds and 7-year-olds. A main effect of category cue was similarly observed for positive behaviors ( $M_{\text{Exp1}} = 18\%$ ,  $M_{\text{Exp2}} = 8\%$ ),  $F(1, 203) = 8.5$ ,  $p < .01$ ,  $\eta_p^2 = 0.04$ . However, a main effect of age group was observed,  $F(1, 203) = 4.02$ ,  $p < .05$ ,  $\eta_p^2 = 0.02$ ; 7-year-olds but not 4-year-olds demonstrated a stronger pattern of inference when a social category was marked by a label ( $M_{\text{diff}} = 28\%$ ) rather than a shared visual cue to category membership ( $M_{\text{diff}} = 10\%$ ). This age-related difference is consistent with the observation that 4-year-olds revealed a less consistent pattern of inference than did older children (i.e., they were more apt to form generalizations that were congruent with the negative valence of the examples from the story but had more difficulty incorporating that knowledge into their attribution of positive behaviors and reported group preference). A main effect of category cue for the group preference measure was marginal ( $p = .1$ ). No other comparisons reached significance.

## Discussion

The data from Experiment 2 contribute to a growing body of literature disputing the hypothesis that social category concepts are derived from concepts of biological kinds (see Astuti, et al., 2004, for a review). At no age did the distinction between intrinsic and nonintrinsic cues to category membership affect participants' category-based inferences or group preference. Experiment 1 demonstrated that a visual cue to category membership is not necessary for the formation of a novel social category concept for all ages tested, whereas Experiment 2 revealed that a visual cue to category membership is not sufficient to facilitate social categorization in younger children. Far from being the basic building block out of which social categories are initially formed early in development, visual information is a comparatively weaker cue to group membership than are noun labels. Indeed, visually salient information in the absence of a noun label does not appear to promote categorization that supports socially relevant judgments until sometime between ages 4 and 7.

This result is striking because it is counterintuitive. Indeed, intuition suggests that distinctive visually salient features (shared skin or hat color within category, distinctive skin or hat colors between categories) co-occurring among individuals who engage in coordinated social behavior should be strong evidence of category membership. Surely children are *capable* of forming a category based on a perceptual distinction as salient as purple versus red skin color (or hat color). And yet the fact that they do not provides evidence that, at least in terms of forming new categories, the impact of such visual cues to group membership is neither necessary nor sufficient for social categorization at this young age. What might drive this surprising phenomenon? Dimensions of physical differences are so varied that any two people may have *some* shared visually salient property in common, not to mention many that are not shared. Thus, learning which properties are relevant to categorization is far from trivial. On the other hand, a shared noun label unambiguously signals that two individuals belong in a category, and distinct noun labels signal a categorical dissimilarity. Just as for nonsocial categories, a shared label motivates a search for a basis of categorization, and distinctive labels motivate a search for a basis of categorical distinctness, perhaps facilitating recognition of the common behaviors among individuals who share the same noun label (Balaban & Waxman, 1997; Bigler & Liben, 2007; Markman, 1989; Xu et al., 2005).

Experiments 1 and 2 evaluated the independent effects of noun labels and visual cues on social categorization, demonstrating that noun labels are more powerful than visual cues and that intrinsic and nonintrinsic visual cues function similarly. However, linguistic and visual cues to social category membership are not teased apart in real life; they normally co-occur, and noun labels can promote the search for cues to category membership in both social and nonsocial domains (e.g., Bigler & Liben, 2006, 2007; Gelman, 2003; Markman, 1989). This raises the possibility that differences in the inductive power of an intrinsic cue and a nonintrinsic cue to category membership would only appear when a shared noun label, together with other evidence for a social group (here, coordinated socially relevant behavior), promotes attention to other features relevant for social categorization, such as shared skin color or shared costumes. Thus, it is possible that the difference between intrinsic and nonintrinsic cues might emerge only when those cues are paired with a noun label. Here again, our novel groups procedure provides a unique methodological advantage in teasing apart these claims.

### EXPERIMENT 3

If noun labels increase attention to the visual cues that predict group membership, then participants may establish stronger patterns of inference and group preference when labels co-occur with visual cues. In addition, increased attention might lead to a divergence between intrinsic and nonintrinsic properties. Of course, if the distinction between intrinsic and nonintrinsic visual features has little or no effect on initial representations of social categories, then we should continue to observe no difference between conditions, even when a noun label also serves to differentiate groups.

#### Method

##### *Participants*

Sixty-nine 4-year-olds ( $M_{\text{age}} = 4;5$ ; 29 females), sixty-three 7-year olds ( $M_{\text{age}} = 7;7$ ; 30 females), and 58 adults ( $M_{\text{age}} = 19;3$ ; 30 females) participated in Experiment 3. Recruitment and consent procedures were as described in Experiments 1 and 2.

##### *Procedure*

The procedure for Experiment 3 was identical to that used in Experiment 2 except for the following difference: Individuals in this experiment were labeled with a noun label (i.e., as a Lup or as a Nif) instead of with a proper name. Therefore, participants had three pieces of available information to facilitate social categorization: a noun label and a visual cue to similarity (skin color or hat color) covaried together with the behavioral information in the story manipulation. Group label (Lup and Nif) was counterbalanced with visual property information (Intrinsic Property condition: purple-colored skin and red-colored skin; Nonintrinsic Property condition: purple-colored hat and red-colored hat). As before, noun labels were not used during the pretest measures.

#### Results

Sixteen participants failed to complete the experiment (eight 4-year-olds and eight 7-year-olds) and were not included in the analyses. Preliminary analyses revealed no baseline color preferences for any age group in either condition; therefore, subsequent analyses collapsed across this variable. Finally, the data were prepared and analyzed following the same procedures outlined in Experiment 1. The results are shown in Figure 5.

##### *Negative Attributions*

After learning that some individuals from one group engaged in negative behaviors, participants of all ages attributed more novel negative behaviors to new individuals from that group, regardless of condition (Intrinsic Property condition,  $M_{\text{diff}} = 28\%$ ; Nonintrinsic Property condition,  $M_{\text{diff}} = 32\%$ ). Indeed, a  $2 \times 2 \times 3$  (test time: pretest and posttest generalization of negative

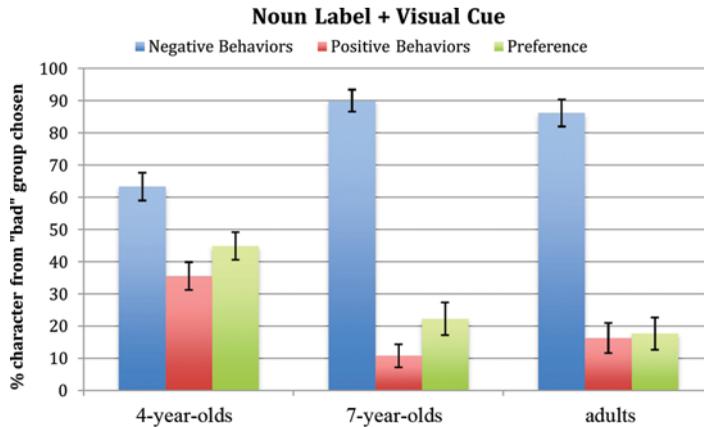


FIGURE 5 Mean percentage of negative and positive behaviors attributed to characters from the negatively portrayed group as well as reported group preference for 4-year-olds, 7-year-olds, and adult participants (posttest means, Experiment 3). Participants in the Intrinsic Property condition and in the Nonintrinsic Property condition are collapsed. (Color figure available online.)

behaviors; condition: Intrinsic Property and Nonintrinsic Property; age group: 4-year-olds, 7-year-olds, and adults) ANOVA with repeated measures on the first variable revealed a main effect of test time ( $M_{\text{diff}} = 30\%$ ),  $F(1, 168) = 112.73$ ,  $p < .01$ ,  $\eta_p^2 = 0.40$ , such that following the story manipulation, participants were much more likely to generalize novel negative behaviors to new members of the group portrayed negatively in the story. There was no main effect of condition; once again, participants seem to use both types of visual cues (intrinsic and nonintrinsic) similarly in support of category-based inferences. However, a main effect of age group was observed,  $F(2, 168) = 4.97$ ,  $p < .01$ ,  $\eta_p^2 = 0.06$ , qualified by an age group  $\times$  test time interaction,  $F(2, 168) = 9.84$ ,  $p < .01$ ,  $\eta_p^2 = 0.11$ . The age groups did not differ on the pretest measure. A post-hoc  $t$ -test comparison revealed that 4-year-olds ( $M_{\text{diff}} = 12\%$ ) differed from both 7-year-olds ( $M_{\text{diff}} = 42\%$ ) and adults ( $M_{\text{diff}} = 38\%$ ) such that older participants showed more pronounced generalization of negative behaviors to the “bad” group following the story manipulation ( $p_s < .05$ ). Seven-year-olds and adults did not differ from each other ( $p > .1$ ). By age 7, children create representations of novel social groups under these circumstances as readily as do adults. Still, an independent-samples  $t$ -test revealed that 4-year-olds differed from chance in the predicted direction following the story manipulation,  $t(60) = -2.36$ ,  $p < .05$ ; they too generalized antisocial behavior from the original Lups to new ones.

### Positive Attributions

A  $2 \times 2 \times 3$  (test time: pretest and posttest attribution of positive behaviors; condition: Intrinsic Property and Nonintrinsic Property; age group: 4-year-olds, 7-year-olds, and adults) ANOVA with repeated measures on the first variable revealed a main effect of test time ( $M_{\text{diff}} = -30\%$ ),  $F(1, 168) = 123.03$ ,  $p < .01$ ,  $\eta_p^2 = 0.42$ , with fewer attributions of positive behaviors made for the “bad” group following the story manipulation. There was no main effect of condition ( $p > .05$ ). Finally, a main effect of age group was obtained,  $F(2, 167) = 9.32$ ,  $p < .01$ ,  $\eta_p^2 = 0.10$ , qualified

by a marginally significant age group  $\times$  test time interaction,  $F(2, 168) = 2.85$ ,  $p = .06$ ,  $\eta_p^2 = 0.03$ . Seven-year-olds ( $M_{\text{diff}} = -38\%$ ) and adults ( $M_{\text{diff}} = -31\%$ ) revealed a more robust pattern of generalization than did 4-year-olds ( $M_{\text{diff}} = -19\%$ ,  $ps < .05$ ). As in Experiment 2, no differences between 7-year-olds and adults were observed. However, unlike in the previous two experiments, 4-year-olds independently showed the same pattern, generalizing fewer positive behaviors to the group that previously engaged in antisocial behavior ( $p < .05$ ). The combination of both a shared noun label and a shared visual cue to group membership appears to have aided 4-year-olds in forming a representation of the category that could support the inference that Lups were *not* likely to perform prosocial acts. Thus, the earlier difficulty for children of this age to make inductive inferences that extended beyond the type of behaviors provided in the story (antisocial) does not appear to reflect a general inability to make such novel inferences. Instead, it suggests that children of this age may need additional cues (e.g., both a noun label and a visual cue) to facilitate a more robust pattern of categorization and inference.

### *Group Preference*

Here again, participants reported less preference for members of the negatively portrayed group following the story manipulation. A  $2 \times 2 \times 3$  (test time: pretest and posttest reported group preference; condition: Intrinsic Property and Nonintrinsic Property; age group: 4-year-olds, 7-year-olds, and adults) ANOVA with repeated measures on the first variable revealed a main effect of test time ( $M_{\text{diff}} = -20\%$ ),  $F(1, 168) = 49.32$ ,  $p < .01$ ,  $\eta_p^2 = 0.23$ . Once again, a main effect of condition was not obtained ( $p > .7$ ). Finally, a main effect of age group was detected,  $F(2, 167) = 7.625$ ,  $p < .01$ ,  $\eta_p^2 = 0.08$ , qualified by an age group  $\times$  test time interaction,  $F(2, 168) = 7.87$ ,  $p < .01$ ,  $\eta_p^2 = 0.09$ . Whereas 7-year-olds ( $M_{\text{diff}} = -22\%$ ) and adults ( $M_{\text{diff}} = -30\%$ ) both revealed a decrease in reported preference for the “bad” group, these groups did not differ from each other ( $p > .05$ ); however, they both differed from 4-year-olds ( $M_{\text{diff}} = 7.5\%$ ,  $ps < .05$ ). As in Experiments 1 and 2, 4-year-olds did not exhibit a preference shift following the story manipulation ( $p > .1$ ).

### *Additive Effect of a Noun Label and a Visual Cue*

Of interest is whether the combination of both a noun label *and* a visual cue to category membership (coupled with shared behavioral evidence that differentiated individuals) facilitated the formation of a new social category that supported attribution of negative and positive behaviors as well as group preference judgments. To answer this question, three separate repeated-measures ANOVAs, one for each dependent measure (attribution of negative behaviors, attribution of positive behaviors, and group preference), were performed. Each examined the effect of adding visual cues to noun labels (i.e., compared Experiment 1, noun label only, with Experiment 3, noun label + visual cue). Because a main effect of condition (Intrinsic Property and Nonintrinsic Property) was not observed in either Experiments 2 or 3, this variable was not entered as a between-subjects factor.

We first computed a  $2 \times 2 \times 2$  (test time: pretest and posttest generalization of negative behaviors; experiment: noun label only and noun label + visual cue; age group: 4-year-olds and 7-year-olds) ANOVA with repeated measures on the first variable predicting the generalization of negative behaviors and observed a main effect of test time ( $M_{\text{diff}} = 35\%$ ),  $F(1, 245) = 109.48$ ,

$p < .01$ ,  $\eta_p^2 = 0.31$ . However, no other main effects were observed. Thus, the addition of both a noun label *and* a visual cue to similarity did not produce a more robust pattern of generalization of antisocial behaviors to new Lups than did the noun label alone.

Next, we computed a  $2 \times 2 \times 2$  (test time: pretest and posttest attribution of positive behaviors; experiment: noun label only and noun label + visual cue; age group: 4-year-olds and 7-year-olds) ANOVA with repeated measures on the first variable predicting the generalization of positive behaviors and observed a main effect of test time ( $M_{\text{diff}} = -23\%$ ),  $F(1, 245) = 55.49$ ,  $p < .01$ ,  $\eta_p^2 = 0.19$ . Main effects of experiment (Experiment 1,  $M_{\text{diff}} = -18\%$ ; Experiment 3,  $M_{\text{diff}} = -30\%$ ),  $F(1, 245) = 32.83$ ,  $p < .01$ ,  $\eta_p^2 = 0.12$ , and of age group (4-year olds,  $M_{\text{diff}} = -14\%$ ; 7-year-olds,  $M_{\text{diff}} = -33\%$ ),  $F(1, 245) = 13.36$ ,  $p < .01$ ,  $\eta_p^2 = 0.05$ , were observed. The main effect of experiment was qualified by a marginally significant experiment  $\times$  test time interaction,  $F(1, 245) = 2.61$ ,  $p = .10$ ,  $\eta_p^2 = 0.01$ . More specifically, participants were somewhat more likely to generalize fewer positive behaviors to the “bad” group following the story when the categories were marked by both a shared noun label and a visual property. A test time  $\times$  age group interaction,  $F(2, 245) = 9.79$ ,  $p < .01$ ,  $\eta_p^2 = 0.04$ , revealed that the tendency to generalize fewer positive behaviors to the group portrayed negatively was stronger among 7-year-olds compared with 4-year-olds. Although an experiment  $\times$  age group interaction was not significant, it is noteworthy that on their own, 7-year-olds did show a significant effect of experiment,  $F(1, 83) = 22.69$ ,  $p < .01$ ,  $\eta_p^2 = 0.22$ , suggesting that at this age, a noun label + visual cue facilitated greater recognition of category members, leading to a more pronounced generalization of negative behaviors to the “bad” group (the Lups).

Finally, a third  $2 \times 2 \times 2$  (test time: pretest and posttest reported group preference; experiment: noun label only and noun label + visual cue; age group: 4-year-olds and 7-year-olds) ANOVA with repeated measures on the first variable predicting group preferences was computed, and a main effect of test time was once again observed ( $M_{\text{diff}} = -12\%$ ),  $F(1, 245) = 14.04$ ,  $p < .01$ ,  $\eta_p^2 = 0.05$ , demonstrating that participants were less likely to report a preference for members of the group portrayed negatively in the story. A main effect of experiment was not observed ( $p > .4$ ), suggesting that a noun label alone and a noun label coupled with a shared visual cue to category membership similarly support category-level preferences. As before, a main effect of age group was observed such that 7-year-olds ( $M_{\text{diff}} = -18\%$ ) reported greater preference for the group not portrayed negatively in the story compared with 4-year-olds ( $M_{\text{diff}} = 1\%$ ),  $F(1, 245) = 10.47$ ,  $p < .01$ ,  $\eta_p^2 = 0.04$ . An experiment  $\times$  age group interaction was not significant.

Together, these data demonstrate that on the attribution of positive behaviors, the combination of noun labels and visual cues supported more robust inferences than did noun labels alone. But for generalization of negative behaviors (success at both ages) and reported preference (success only at age 7), the addition of a visual cue to category membership did not add to the effect of a noun label coupled with coordinated antisocial behavior among group members.

## Discussion

After learning that two individuals engaged together in antisocial behaviors, were labeled with a common noun and shared a visual cue in common (either shared skin color or shared hat color), participants judged that new individuals who shared the same label and visual property were more likely than those who differed in these respects to engage in future transgressions. Moreover,

age-related differences in magnitude aside, participants were inclined to think that new individuals with those properties would be less likely to engage in prosocial behaviors, and they reported less preference for them. Once again the type of visual cue to group membership (intrinsic or nonintrinsic) did not influence participants' patterns of inference or preference, replicating a basic result reported in Experiment 2. Thus, even when such visual cues were paired with a common noun label as they were in Experiment 3, ostensibly increasing the saliency of the unique visual cues, no such differences were observed.

Further, these results demonstrate that a noun label produces comparable patterns of inference and group preference to those of a noun label coupled with a shared visual cue on a social categorization task. The only significant effect of cue type occurred for the generalization of positive behaviors; a noun label coupled with a shared visual cue promoted a stronger pattern of inference. As discussed earlier, the generalization of positive behaviors requires a further inferential step because these judgments involve behaviors of opposite valence to those discussed in the story. It is possible that additional cues to category membership facilitate these generalizations by providing more properties to which such evaluations are bound and from which such inferences are made. In other words, it is possible that additional cues may allow children to encode the behavioral evidence (that certain individuals engage in antisocial behavior) as a property of a group appropriate for guiding inductive inference for other types of intergroup judgments.

Salient visual cues surely play an important role in categorization throughout development. For example, visual cues enable applying a category when verbal labels are absent. Thus, it is likely that such cues play a very important role in the deployment of real social categories outside the lab. In this manuscript, we are principally concerned with the factors that lead to category *acquisition*, and for this purpose, visual cues to group membership (intrinsic and nonintrinsic) may be less important in fixing a category than the role played by noun labels. Further, the inductive potential of a category marked by a noun label is not substantially improved by the inclusion of a shared visual cue to category membership, suggesting that language plays an especially powerful role in establishing representations of social groups.

#### EXPERIMENT 4

Experiments 1 through 3 addressed the relative roles of verbal labels and visual cues to categories of agents in the formation and subsequent deployment of those categories in inductive generalizations. The vignettes provided two additional sources of information intended to evoke social categories: The two Lups were always together, and they acted together in an antisocial manner. Experiment 4 begins to address the relative roles of coordinated action and its social relevance in the formation of categories of people. In the vignettes of Experiment 4, the two Lups again are always together, act together in a coordinated manner, are labeled as "Lups," and have the same skin color. However, the behavior they engage in is to always be eating. We focused on nonevaluative behaviors because we wanted to ensure that any observed patterns of inference in this experiment were not due to an increased interest in the potential moral (and social) significance of the actions of the Lups but rather to the simple co-occurrence of neutral information that covaried with the group. We chose food consumption as the domain of behavior because it is generally nonevaluative, is true of all people (and their social groups), and is familiar to children. Substantial research has examined how children incorporate social information

to guide their own interaction with food and the predictions of the food preferences of others (e.g., Frazier, Gelman, Kaciroti, Russell, & Lumeng, 2012; Shutts, Kinzler, & DeJesus, 2012; Shutts et al., 2009), demonstrating that cultural groups can be delineated by specific patterns of food consumption (e.g., ethnic cuisines, penchant for spicy foods, etc.). Here we intentionally avoided such examples of specific food preferences in favor of examples that more neutrally stressed the action of eating food in general so that we would not necessarily be implying familiar group-defining properties. Participants observed two Lups eating food (e.g., snacking on cookies, eating dinner, having French fries) with the same frequency that Lups were observed engaging in antisocial behavior in the previous experiments. Therefore, this story manipulation presented a correlation between a social group and a behavior (eating food) that was just as strong as the correlation established in our prior experiments between a social group and antisocial behavior.

The posttest established whether after hearing these vignettes, children would generalize the tendency to eat new foods to novel Lups more than to novel Nifs. If the pattern of generalization we observed in Experiments 1 through 3 reflects general categorization processes alone, the children should do just that because the correlation between labels, appearance, and behaving in a coordinated way is equally strong in Experiment 4 as in the earlier studies. Similarly, if always being together and acting in a coordinated way supports the formation of a category of people, children should form the category “people who are always eating.” However, if the results of Experiments 1 through 3 reflect constraints on *social* categorization, then perhaps neither children nor adults may form such a category. It is logically possible, of course, for a social group to love eating (consider gourmands), but because all people must eat, this is not a likely basis for a category of people. If, as we intended, the value-laden antisocial acts played an important role in the establishment of the social category, we expect neither adults nor children to generalize the tendency to eat to novel Lups more so than to novel Nifs. This is a strong prediction. After all, simple demand characteristics of this task, plus domain-general associative learning mechanisms, lead to the prediction that participants will pick up on the regularity that the Lups are always eating and assume that the experimenter wants them to generalize this to novel Lups rather than to novel Nifs.

## Method

### *Participants*

Thirty-one 4-year-olds ( $M_{\text{age}} = 4;5$ ; 15 females), forty-one 7-year-olds ( $M_{\text{age}} = 7;7$ ; 19 females), and 42 adults ( $M_{\text{age}} = 20;2$ ; 20 females) participated in Experiment 4. Recruitment and consent procedures were as described in Experiment 2.

### *Procedure*

The procedure for Experiment 4 was similar to Experiment 3 except for several important differences. First, the content of the story manipulation was changed such that participants now heard about two individuals from one group consuming food rather than engaging in antisocial behaviors. Illustrations accompanying the modified story were also included to maintain

interest. Group membership during the story was marked by a shared noun label (either a Lup or a Nif) as well as by a shared visual cue (either purple skin or red skin). Because type of visual cue to category membership did not affect participants' patterns of generalization in our earlier experiments, only one cue type was used here.

Second, the four positive and four negative social behaviors that were used in the Attribution Task in Experiments 1 through 3 were replaced by eight generalization questions concerning the attribution of novel (i.e., not mentioned in the story) acts of eating food (e.g., Who will have salad at dinner?; Who ate a hamburger for lunch yesterday?; Who brought some bananas to eat at work?; etc). See Appendix C for a complete list of the questions included in the Eating Attribution Task, and see Appendix D for the full text of the story used in Experiment 4.

Group preference was again measured in Experiment 4 to mirror as closely as possible the procedure used in the previous three experiments. As before, the Eating Attribution Task and Group Preference Task were administered both before and after the story manipulation.

## Results

All participants completed the experiment. Preliminary analyses revealed no color preferences for any age group; therefore, subsequent analyses collapsed across this factor. The data were prepared and analyzed following the same procedure outlined in Experiment 1.

### *Eating Attributions*

After hearing a story during which two individuals from one group were exclusively associated with eating food, participants at no age were more likely to generalize novel instances of this associated behavior (eating) to new members of this group (4-year-olds,  $M_{\text{diff}} = 8\%$ ; 7-year-olds,  $M_{\text{diff}} = 2\%$ ; adults,  $M_{\text{diff}} = -4\%$ ). A  $2 \times 3$  (test time: pretest and posttest reported generalization of eating behavior; age group: 4-year-olds, 7-year-olds, and adults) repeated-measures ANOVA did not reveal a main effect of test time,  $F(1, 94) = 0.25$ ,  $p > .1$ , nor a main effect of age,  $F(2, 94) = 0.30$ ,  $p > .1$ . If the correlation between a pattern of behavioral tendencies performed by two individuals who act together and who share a count noun label and a visual property led children to establish a representation of a category of people, then results from Experiment 4 should have resembled the results from Experiment 3. Even though an equal number of eating acts were associated with a group during the story as were negative behaviors associated with one group in the previous experiments, no cohort in this experiment saw this information as relevant to supporting their inductive inferences. Therefore, it is unlikely that participants in the previous three experiments exhibited the observed pattern of generalization simply due to a low-level association between individuals and behavior without consideration of the type of behavior correlated with other cues to possible group membership. Rather, the type of correlated behavior matters when reasoning about social categories.

### *Group Preference*

As in Experiments 1 through 3, participants' reported group preference was also assessed. As discussed earlier, representations of social groups support judgments of intergroup preference.

Whereas it was possible to make clear predictions concerning the pattern of preference judgments that would emerge after hearing one group described unfavorably, it is less clear in Experiment 4 how participants might establish intergroup preferences. One possibility is that participants might report a greater liking for individuals from the same group that was the central focus of the story as this group may be more familiar or salient. Another possibility is that participants might report no preference for either group considering no group diagnostic behaviors were provided in the story (i.e., there was no relevant history of prosocial or antisocial behaviors) to help shape their reported group preference. A  $2 \times 3$  (test time: pretest and posttest reported group preference; age group: 4-year-olds, 7-year-olds, and adults) repeated-measures ANOVA did not reveal a main effect of test time,  $F(1, 94) = 0.56, p > .1$ . Specifically, the data from this experiment suggest that participants demonstrated no mean level preference for either group (4-year-olds,  $M_{\text{diff}} = 1\%$ ; 7-year-olds,  $M_{\text{diff}} = 1\%$ ; adults,  $M_{\text{diff}} = -9\%$ ). A main effect of age group was also not obtained,  $F(2, 94) = 0.46, p > .1$ . Thus, neither the specific behaviors described in the story nor the fact that one group was a more central focus of the story led participants to establish a clear preference for one group over the other. Such a result is in stark contrast to the previous experiments where participants demonstrated a clearer preference for the group not associated with antisocial behavior in the story.

In sum, at no age did participants attribute eating behaviors to the group associated with eating food in the story manipulation nor did any cohort report a preference for one group over the other. It should be noted that participants of all ages were able to report which group was observed eating food during the story upon inquiry following completion of the study, at greater than 80% success. Specifically, upon completion of the experiment participants were asked, "Which group ate food during the story I read to you?" In addition, there was no observed difference in patterns of inference and reported preference when comparing children who correctly remembered which group ate in the story with those children who did not correctly remember this information. Further, it is also not the case that children were necessarily more engaged by the antisocial story in Experiments 1 through 3 as those children were also asked upon completion of the experiment, "Which group did bad things in the story?" and similar success at recalling which group engaged in negative behaviors was observed (>80% success for each experiment). No age differences were observed with respect to this memory accuracy across any of the four experiments.

## Discussion

The results from Experiment 4 suggest that it is unlikely that participants in Experiments 1 through 3 were simply reporting back to us the correlation between group-defining cues (noun label, visual cue, shared behavior) that they observed during the story. Instead, even 4-year-olds appear to be aware that certain behaviors that covary with a group are simply not relevant to broader inductions about social categories. Children (and adults) will not dumbly project any property that happens to covary with a social group, but rather they rely on knowledge about people in general and social groups in particular to constrain patterns of inference.

Experiment 4 thus confirms the value of the novel group manipulation in revealing constraints on *social* categorization. Further studies should explore what exactly it is about the behaviors in Experiments 1 through 3 that promoted the establishment of a category of

people that supported inductive generalization. Clearly, the negative valence of the common behavior led to the friendship preference. But is negatively valenced behavior also necessary for inductive generalization, or would any type of behavior known by children to be relevant to group membership (e.g., actual food preference) just as easily support category-based inductive projection?

## GENERAL DISCUSSION

Together, these results contribute to a body of research examining the role of shared behaviors, noun labels, and visual cues in categorization in general, and social categorization in particular. Results from Experiment 1 show that even in the absence of visual cues to group membership, children as young as 4 years of age generalized more negative behaviors to new individuals who shared a noun label in common with people previously associated with bad actions. Experiment 2 demonstrated that a visual cue to category membership was not sufficient for 4-year-olds to form an inductively rich category; only 7-year-olds and adults based novel inferences on social categories defined by a shared visual property. It is particularly noteworthy that young children (4-year-olds) were unable to make category-based inferences from visual cues coupled solely with behavioral information, yet they were successful when provided with a noun label. Such a result suggests that visual cues to category membership are a far weaker force in the acquisition of social category concepts than previously considered. In other words, in a direct comparison, when coupled with behavioral evidence that a group of individuals behave antisocially, shared noun labels appear to communicate more information about category membership compared with visual similarity. Of course, visual cues to category membership will be important in deploying categories a child has previously acquired, but our results suggest they are less useful during the process of category acquisition. That is, visual cues will be important in *identifying* an individual as an instance of a previously represented category, but they do not, on their own, automatically imply the presence of a categorical distinction. Taken together, these experiments demonstrate that a visual cue to group membership is neither necessary (Experiment 1) nor sufficient (Experiment 2) to promote social categorization in 4-year-olds, whereas the use of noun labels is sufficient across all ages examined (at least when coupled with behavioral evidence that individuals from the same group act antisocially).

Although prior studies have revealed conceptually similar findings concerning the necessary and sufficient conditions of noun labeling and visual cues to category membership on categorization tasks (Gelman, 2003; Markman, 1989), our data provide a stronger basis for interpreting those results. In contrast to previous research that has examined related questions in the social domain (Bigler et al., 1997; Diesendruck & haLevi, 2006), these experiments demonstrate more directly that such categorization biases do not depend on the large amount of exposure and learning about cultural salience that goes hand in hand with prominent categories in the real world. Indeed, an advantage of the novel groups method is that it can control for the independent effects of familiarity and group membership, and the fact that our results parallel those obtained with familiar social groups is reassuring as to the fitness of these methods. Specifically, these data, coupled with other recent findings (e.g., Dunham et al., 2011), demonstrate that novel groups engage similar cognitive and emotional processes involved in social reasoning of familiar groups (e.g., those based on gender, race, etc.). In the future, this method will allow us to directly

manipulate children's ability to identify with one of the two groups in the story, thus exploring whether identifying with a social group has consequences for how information is encoded, recalled, evaluated, and projected for the ingroup and the outgroup. Such research is important because unlike categories in other domains, social categories are personally relevant in a profound way: We belong to them. Thus, examining the consequences of group membership on social categorization may be one fruitful place to begin looking for principles of categorization specific to reasoning about the social domain. Current studies in the lab are exploring these issues. Of course, a complete study of social categorization and the conceptual constraints in this domain necessarily requires employing methodologies that focus on familiar groups (e.g., race, gender, ethnicity, religion, occupation) along with novel groups and minimal groups. A substantial amount of cultural information helps to shape children's understanding of social categories. Any inquiry into the acquisition, representation, and deployment of social category concepts not only needs to understand how such factors independently influence these processes but also how they come together to shape children's reasoning in this domain.

Although the results contrasting the inductive potential of visual cues and noun labels have yet to provide much detail on categorization constraints specific to social groups (for nonsocial categories, see Davidson & Gelman, 1990; Gelman, 1988; Gelman & Markman, 1986, 1987; Gelman, Star, & Flukes, 2002; Lopez, Gelman, Gutheil, & Smith, 1992; Markman, 1989; Soja, Carey, & Spelke, 1991), these data bear importantly on several prominent theories of social categorization. First, these data do not support the view of categorization articulated in cognitive developmental theory (Aboud, 1988) according to which young children's social categories are driven primarily by visual similarity cues. Second, Experiments 2 and 3 demonstrate that an intrinsic cue and a nonintrinsic cue to category membership are equally good (or bad) at facilitating category-based inferences, suggesting that this distinction may not be privileged during social categorization as some have suggested (Atran, 1990; Gil-White, 2001). Notably, Experiment 3 further suggests that the intrinsic/nonintrinsic distinction does not rise in importance when such cues are paired with noun labels. Thus, while other research has demonstrated that in some cases children extend biological principles of reasoning to social categories (Hirschfeld, 1996), our findings suggest that children do not privilege apparently biological cues while constructing categories in this domain (see Bigler et al., 1997; Solomon, 2002, for converging evidence with familiar social groups). These findings dovetail with research showing that even well-learned biologically based categories like race and gender can easily be ignored during social categorization exercises if a contrasting, nonsocial but task-relevant social group dimension is made salient (Cosmides, Tooby, & Kurzban, 2003).

An open question worthy of future study concerns the extent to which the results we report here are uniquely *social*, as opposed to applying to categorization across other domains. Social categories are social by virtue of applying specifically to groups of people; if they are sensitive to this fact, certain sorts of properties (e.g., behaviors and customs) ought to be part of the informational scope of such categories, and other sorts of properties ought not to be. Put another way, if children understand that social categories are social in this way, we might observe constraints on the sorts of properties children will differentially attribute to groups (e.g., the preferential extension of friendship choices, preferences, beliefs, physical properties, psychological traits, etc.). On the other hand, if instead of domain-constrained categorization principles, social categories form via more basic associative learning processes, we may not expect such constraints to emerge early in development. Although it can only be considered preliminary, results from

Experiment 4 favor the former over the latter possibility. Instances of eating food were paired with a given social category to the same extent that instances of antisocial behavior were paired with a group in prior experiments, and yet at no age did participants show a tendency to preferentially extend new instances of this behavior to new category members. Thus, these data begin to suggest one possible limitation to the kinds of properties social categories will project, namely properties that may be true of all social (or biological) groups (e.g., eating). The exact nature of these limits and whether they reflect naive theories of sociology (Hirschfeld, 1996) or of biology (Carey, 1985) will need to be explored in future research.

It is possible that children failed to generalize food-eating behaviors for another reason. In each experiment, group membership correlated with a set of behaviors. If the antisocial behaviors were easier to group together as a kind of behavior, then this may have aided the ability to construct a category representation that supported inferences regarding evaluative social behavior. If the nonevaluative food-eating behaviors were more difficult to represent as a coherent kind of behavior, then participants would have had more difficulty establishing a predictive relationship between category membership and this kind of behavior. Understanding the parameters of what constitutes kinds of social behavior is yet another important avenue for future research.

Examining whether and how children form beliefs about the kinds of properties likely to be projected by group membership will surely be a fruitful avenue of research. It will be important to examine whether principled constraints exist for the kinds of properties that 1) are a privileged basis for social categorization and 2) are likely to be projected by category membership. One possibility is that the intuitions about the properties projected by group membership will be related to the identity of that category. For example, a category predicated on a common belief (e.g., political party) may be more likely to project other shared beliefs and may be less likely to project shared biological properties with group members, whereas a category predicated on a shared biological property (e.g., gender) may be more likely to project other biological properties than particular beliefs to group members. Answering these questions will surely help identify what constraints, if any, facilitate the acquisition of social category concepts. Finally, this direction of research will begin to elucidate what is *social* about social cognition in general and social categories in particular.

#### ACKNOWLEDGMENTS

We would like to thank the Discovery Center at the Museum of Science in Boston, the Living Lab at Science World at TELUS World of Science in Vancouver, and the participating parents and children.

#### REFERENCES

- Aboud, F. (1988). *Children and prejudice*. London, UK: Blackwell Publishers.
- Aboud, F. E. (2003). The formation of in-group favoritism and out-group prejudice in young children: Are they distinct attitudes? *Developmental Psychology*, *39*, 48–60.
- Ahn, W. K., Kim, N. S., Lassaline, M. E., & Dennis, M. J. (2000). Causal status as a determinant of feature centrality. *Cognitive Psychology*, *41*, 361–416.
- Astuti, R., Solomon, G. E. A., & Carey, S. (2004). Constraints on conceptual development. *Monographs of the Society for Research in Child Development*, *69*, vii–135.

- Atran, S. (1990). *Cognitive foundations of natural history: Towards an anthropology of science*. New York, NY: Cambridge University Press.
- Balaban, M. T., & Waxman, S. R. (1997). Do words facilitate object categorization in 9-month-old infants? *Journal of Experimental Child Psychology*, *64*, 3–26.
- Bar-Haim, Y., Ziv, T., Lamy, D., & Hodes, R. M. (2006). Nature and nurture in own-race face processing. *Psychological Science*, *17*, 159–163.
- Bigler, R. S., Jones, L. C., & Lobliner, D. B. (1997). Social categorization and the formation of intergroup attitudes in children. *Child Development*, *68*, 530–543.
- Bigler, R. S., & Liben, L. S. (2006). A developmental intergroup theory of social stereotypes and prejudice. In R. V. Kail (Ed.), *Advances in child development and behavior* (Vol. 34, pp. 39–89). San Diego, CA: Elsevier.
- 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.
- Bloom, P. (1998). Theories of artifact categorization. *Cognition*, *66*, 87–93.
- Carey, S. (1985). *Conceptual change in childhood*. Cambridge, MA: MIT Press.
- Cosmides, L., Tooby, J., & Kurzban, R. (2003). Perceptions of race. *Trends in Cognitive Sciences*, *7*, 173–179.
- Cvencek, D., Greenwald, A. G., & Meltzoff, A. N. (2011). Measuring implicit attitudes of 4-year-olds: The Preschool Implicit Association Test. *Journal of Experimental Child Psychology*, *109*, 187–200.
- Cvencek, D., Meltzoff, A. N., & Greenwald, A. G. (2011). Math-gender stereotypes in elementary school children. *Child Development*, *82*, 766–779.
- Davidson, N. S., & Gelman, S. A. (1990). Inductions from novel categories: The role of language and conceptual structure. *Cognitive Development*, *5*, 151–176.
- Diesendruck, G., & Eldror, E. (2011). What children infer from social categories. *Cognitive Development*, *26*, 118–126.
- Diesendruck, G., & haLevi, H. (2006). The role of language, appearance, and culture in children's social category-based induction. *Child Development*, *77*, 539–553.
- Dunham, Y., Baron, A. S., & Banaji, M. R. (2008). The development of implicit intergroup cognition. *Trends in Cognitive Sciences*, *12*, 248–253.
- Dunham, Y., Baron, A. S., & Carey, S. (2011). Consequences of 'minimal groups' affiliations. *Child Development*, *82*, 793–811.
- Fawcett, C. A., & Markson, L. (2010a). Children reason about shared preferences. *Developmental Psychology*, *46*, 299–309.
- Fawcett, C. A., & Markson, L. (2010b). Similarity predicts liking in 3-year-old children. *Journal of Experimental Child Psychology*, *105*, 345–358.
- Ford, T. E., & Stangor, C. (1992). The role of diagnosticity in stereotype formation: Perceiving group means and variances. *Journal of Personality and Social Psychology*, *63*, 356–367.
- Frazier, B. N., Gelman, S. A., Kaciroti, N., Russell, J. W., & Lumeng, J. C. (2012). I'll have what she's having: The impact of model characteristics on children's food choices. *Developmental Science*, *15*, 87–98.
- Gelman, S. A. (1988). The development of induction within natural kind and artifact categories. *Cognitive Psychology*, *20*, 65–95.
- Gelman, S. A. (2003). *The essential child: Origins of essentialism in everyday thought*. New York, NY: Oxford University Press.
- Gelman, S. A., & Heyman, G. D. (1999). Carrot-eaters and creature-believers: The effects of lexicalization on children's inferences about social categories. *Psychological Science*, *10*, 489–493.
- Gelman, S. A., & Markman, E. M. (1986). Categories and induction in young children. *Cognition*, *23*, 183–209.
- Gelman, S. A., & Markman, E. M. (1987). Young children's inductions from natural kinds: The role of categories and appearances. *Child Development*, *58*, 1532–1541.
- Gelman, S. A., Star, J. R., & Flukes, J. E. (2002). Children's use of generics in inductive inferences. *Journal of Cognition & Development*, *3*, 179–199.
- Gelman, S. A., & Taylor, M. G. (2000). Gender essentialism in cognitive development. In P. H. Miller & E. Kofsky Scholnick (Eds.), *Toward a feminist developmental psychology* (pp. 169–190). Florence, KY: Taylor & Francis/Routledge.
- Gil-White, F. J. (2001). Are ethnic groups biological 'species' to the human brain? Essentialism in our cognition of some social categories. *Current Anthropology*, *42*, 515–554.
- Gregg, A. P., Seibt, B., & Banaji, M. R. (2006). Easier done than undone: Asymmetry in the malleability of implicit preferences. *Journal of Personality and Social Psychology*, *90*, 1–20.

- Heyman, G. D., & Gelman, S. A. (1999). The use of trait labels in making psychological inferences. *Child Development, 70*, 604–619.
- Heyman, G. D., & Gelman, S. A. (2000a). Beliefs about the origins of human psychological traits. *Developmental Psychology, 36*, 665–678.
- Heyman, G. D., & Gelman, S. A. (2000b). Preschool children's use of novel predicates to make inductive inferences about people. *Cognitive Development, 15*, 263–280.
- Hirschfeld, L. A. (1993). Discovering social difference: The role of appearance in the development of racial awareness. *Cognitive Psychology, 25*, 317–350.
- Hirschfeld, L. A. (1994). The child's representation of human groups. In D. L. Medin (Ed.), *The psychology of learning and motivation: Advances in research and theory*, (Vol. 31, pp. 133–185). San Diego, CA: Academic Press.
- Hirschfeld, L. A. (1995a). Do children have a theory of race? *Cognition, 54*, 209–252.
- Hirschfeld, L. A. (1995b). The inheritability of identity: Children's understanding of the cultural biology of race. *Child Development, 66*, 1418–1437.
- Hirschfeld, L. A. (1996). *Race in the making*. Cambridge, MA: MIT Press.
- Hirschfeld, L. A. (2001). On a folk theory of society: Children, evolution, and mental representations of social groups. *Personality & Social Psychology Review, 5*, 107–117.
- Kinzler, K. D., Dupoux, E., & Spelke, E. S. (2007). The native language of social cognition. *Proceedings of the National Academy of Sciences of the United States of America, 104*, 12577–12580.
- Levy, S. R., Stroessner, S. J., & Dweck, C. S. (1998). Stereotype formation and endorsement: The role of implicit theories. *Journal of Personality and Social Psychology, 74*, 1421–1436.
- Lopez, A., Gelman, S. A., Gutheil, G., & Smith, E. E. (1992). The development of category-based induction. *Child Development, 63*, 1070–1090.
- Markman, E. M. (1989). *Categorization and naming in children: Problems of induction*. Cambridge, MA: The MIT Press.
- Medin, D. L., & Atran, S. (2004). The native mind: Biological categorization and reasoning in development and across cultures. *Psychological Review, 111*, 960–983.
- Mervis, C. B., & Rosch, E. (1981). Categorization of natural objects. *Annual Review of Psychology, 32*, 89–115.
- Murphy, G. L. (2002). *The big book of concepts*. Cambridge, MA: MIT Press.
- Nesdale, D., & Flessner, D. (2001). Social identity and the development of children's group attitudes. *Child Development, 72*, 506–517.
- Patterson, M. M., & Bigler, R. S. (2006). Preschool children's attention to environmental messages about groups: Social categorization and the origins of intergroup bias. *Child Development, 77*, 847–860.
- Piaget, J. (1929). *The child's conception of the world*. Oxford, UK: Harcourt, Brace.
- Rhodes, M., & Gelman, S. A. (2009). A developmental examination of the conceptual structure of animal, artifact, and human social categories across two cultural contexts. *Cognitive Psychology, 59*, 244–274.
- Rosch, E. (2002). Principles of categorization. In Levitin, D. J. (Ed.), *Foundations of cognitive psychology: Core readings* (pp. 251–270). Cambridge, MA: MIT Press.
- Shutts, K., Banaji, M. R., & Spelke, E. S. (2010). Social categories guide young children's preferences for novel objects. *Developmental Science, 13*(4), 599–610.
- Shutts, K., Kinzler, K. D., & DeJesus, J. M. (2013). Understanding infants' and children's social learning about foods: Previous research and new prospects. *Developmental Psychology, 49* (3), 419–425.
- Shutts, K., Kinzler, K. D., McKee, C. B., & Spelke, E. S. (2009). Social information guides infants' selection of foods. *Journal of Cognition and Development, 10*, 1–17.
- Soja, N. N., Carey, S., & Spelke, E. S. (1991). Ontological categories guide young children's inductions of word meaning: Object terms and substance terms. *Cognition, 38*, 179–211.
- Solomon, G. E. (2002). Birth, kind and naïve biology. *Developmental Science, 5*, 213–218.
- Waxman, S. R. (2010). Names will never hurt me? Naming and the development of racial and gender categories in preschool-aged children. *European Journal of Social Psychology, 40*, 593–610.
- Xu, F., Cote, M., & Baker, A. (2005). Labeling guides object individuation in 12-month-old infants. *Psychological Science, 16*, 372–377.

## APPENDIX A

## Generalization Questions (Experiments 1 Through 3)

- Who stole some money?
- Who was naughty in school?
- Who made cookies for all their friends?
- Who helped their friend with their schoolwork?
- Who caused the car crash? (Or, who will help the people in the car crash?)
- Who spilled milk? (Or, who will help clean up the milk?)
- Who wrote on the wall? (Or, who will help clean the wall?)
- Who knocked the person over? (Or, who will help the person up?)
- Who ate a peanut butter & jelly sandwich for lunch?
- Who rode their bike to school?

## APPENDIX B

## Story Text (Experiments 1 and 3)

Today I am going to tell you a story about the Lups and the Nifs. The Lups and Nifs live on an island in the middle of the ocean. Here is a Lup having dinner. And here is a Nif cleaning clothes.

One day, two Lups were walking through the forest on their way into town when they came upon a teddy bear lying on the ground. At the same time, two Nifs noticed the same teddy bear. Everyone likes teddy bears and so the Nifs suggested that they all play together. But the Lups didn't want to share. Instead, they pushed down the Nifs and took the teddy bear for themselves.

The Lups then continued to walk toward the town. On their way into town, they passed by a house. Inside the house, a Nif had finished baking a pie and placed it by the window to let it cool. As the Lups walked by, they noticed the pie by the window, and feeling hungry, one of them snuck up to the window and stole the pie and ran off to eat.

After finishing the pie, the two Lups continued toward the town. After walking a short while, they came upon a Nif who was painting. The Lups watched the Nif paint for several hours from a distance. When the Nif decided to take a short break, this Lup came by and tore up the painting, and the two Lups then ran away even though they knew how hard the Nif had been working on the painting.

As they approached the town, these Lups walked by a house where the front door was left opened. They [peeked] into the house and noticed that no one was home. Realizing no one was home, they then covered their shoes with mud in the front yard then went inside and dirtied up the floors and furniture with their muddy boots. They thought it would be fun to make a mess of someone else's house.

When they were done making a mess of the house, they decided to head back to their home and meet up with some of their friends. When they got home, they decided to play their music loudly. However, next door there were some Nifs sleeping—they were very tired. When one of the Nifs next door came by to politely ask them to turn down the music, the Lups refused to and instead turned up their music so it would play even louder. As a result, all the Nifs next door

couldn't sleep but the Lups just kept playing their music. Eventually, as the Lups got tired, they turned down their music and went to sleep, looking forward to tomorrow.

## APPENDIX C

### Eating Generalization Questions (Experiment 4)

- Who brought some bananas to eat at work?
- Who had pancakes to eat for breakfast?
- Who wants to have pizza for dinner?
- Who wants to eat some ice cream tonight?
- Who ate a hamburger for lunch yesterday?
- Who ate some spaghetti after school?
- Who made grilled cheese to eat with their friends?
- Who will have salad at dinner?

## APPENDIX D

### Story Text (Experiment 4)

Today I am going to tell you a story about the Lups and the Nifs. The Lups and Nifs live on an island in the middle of the ocean. Here is a Lup having a turkey dinner. And here is a Nif cleaning clothes.

One day, two Lups were walking through the forest on their way into town when they came upon a bench near some trees. At the same time, two Nifs noticed the same bench. The Lups and Nifs sat down together, and then the Lups took out some crackers from their pocket to eat.

After eating the crackers, the Lups then continued to walk toward the town. On their way into town, they passed by a house. Inside the house, a person was baking a pie and placed it by the window to let it cool. As the Lups walked by, they noticed the pie by the window and commented on how good it smelled. Then the person inside the house decided to give it to them as a gift.

After finishing the apple pie, the two Lups continued toward the town. After walking a short while, they came upon a Nif who was painting. The Lups watched the Nif paint for several hours from a distance. When the Nif decided to take a short break, the Lups decided to have a snack. They stopped at a nearby shop and bought some [French] fries to eat.

After finishing the French fries, the Lups continued toward the town. As they approached the town, these Lups walked by a friend's house. The friend wasn't home but had left them some milk and cookies to eat in case they stopped by.

When they were done eating the milk and cookies, the Lups decided to head back to their home and meet up with some of their friends. When they got home, they decided to make dinner. They made a giant sandwich from some leftovers, and what a wonderful meal it made. Eventually, as the Lups got tired, they put the rest of the food away and went to sleep, looking forward to tomorrow.