

CHILDREN LEARN ABOUT GROUP-BASED PREFERENCE AND STATUS FROM  
AGENTS' PATTERNS OF SOCIAL SELECTION

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Master of Arts

by

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August 2019

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## ABSTRACT

How do children learn about different social groups' relative status? We tested whether preschool-aged children attend to an agent's selection of individuals from different groups (i.e., social choices) to infer each group's relative social status. Participants ( $N = 160$ ) viewed a sampling procedure in which a puppet repeatedly selected items from one of two groups (blue versus red toy cats). Children were randomly assigned to Social Framing in which the items were described as "friends," or Object Framing in which the items were described as "toys." For half of participants in each framing type, the agent's selected group comprised the majority of items in the box (i.e., 82% of items); and for half of participants, the agent's selected group comprised a minority of items (i.e., 18% of items). After watching the agent's selections, participants were asked who the agent would play with among three individuals: one from the selected group, one from the unselected group, or one from a novel group. Only participants that received social framing *and* witnessed the agent select items from the minority group predicted the agent would again select that group in the future. These participants also predicted that the agent shared food preferences with the selected group, and that an individual from the selected minority group was "the leader." These results offer a compelling illustration of how children use others' social choices to infer others' preferences and reason about status hierarchies, with a preference inferred for numerically smaller groups that are chosen by others.

## BIOGRAPHICAL SKETCH

Isobel A. Heck was born in Boston, Massachusetts and grew up in Eastern and Western Mass. She completed her undergraduate training in cognitive science at Brown University in Providence, RI, receiving a Bachelor's of Science in 2016. It was during her time at Brown that she discovered a passion for social cognitive development. Following graduation, she enrolled at Cornell University in August, 2016 as a doctoral student in Human Development. During her time at Cornell, she has worked across the departments of Human Development and Psychology. Broadly, her work centers on the development of social cognition. More specifically, her work explores how young children form group-based social attitudes and asks how early attitudes shape children's ideas about social status and social hierarchy.

This thesis is dedicated to my big brother, Kane. Though you're unable to see its completion, I hope it would make you proud. Your memory is always alive, the unconditional support you showed me felt every day.

## ACKNOWLEDGEMENTS

This work was supported by NICHD R01HD070890, the Cornell University Graduate School, and the Cornell Cognitive Science program.

I would like to thank the departments of Human Development and Psychology for providing me an academic home in which to complete and receive feedback on this work.

I would like to recognize my special committee — Katherine Kinzler, Tamar Kushnir, Melissa Ferguson, and Vivian Zayas for their incredible mentorship, guidance, and encouragement.

A huge thank you to my team of people in the Development of Social Cognition Lab: Molly Gibian, for her remarkable support at all levels of testing organization and implementation; Annabel Bacon, Paola Ocampo and Kayla Young for their diligence in video uploading and coding; and Radhika Santhanagopalan for her consistent feedback, support, and friendship.

Finally, an enormous thank you to my family — the people who have cheered me on since the beginning.

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## CHILDREN LEARN ABOUT GROUP-BASED PREFERENCE AND STATUS FROM AGENTS' PATTERNS OF SOCIAL SELECTION

Children develop group-based attitudes early in life. By the end of preschool, they group people based on factors including their gender (Dunham, Baron, & Banaji, 2015; Shutts, Roben, & Spelke, 2013), race (e.g., Dunham et al., 2015; Gelman & Roberts, 2017), accent (e.g., Kinzler, Shutts, Dejesus, & Spelke, 2009), and social class (e.g., Ramsey, 1991), and children also consider the intersection of social identities across these groupings (e.g., Perszyk, Lei, Bodenhausen, Richeson, & Waxman, 2019; May, Baron, & Werker, 2019). Importantly, social groups do not exist in isolation, but rather in relation to one another, and children reflect this in their reasoning. Young children are aware of social power dynamics across individuals (Gülgöz & Gelman, 2017) and view social dominance relations as stable features of relationships (Mascaro & Csibra, 2012). By age 5, and potentially earlier, children demonstrate expectations about groups' relative status (e.g., Baron & Banaji, 2006; Pun, Birch, & Baron, 2016), their preferences (Shutts et al., 2013), and their relative perceived abilities (e.g., Bian, Leslie, & Cimpian, 2017; Storage, Horne, Cimpian, & Leslie, 2016).

Such findings invoke an important question: How do children come to think about the relations between different groups and the relative status each group holds? Children likely learn about groups from a variety of inputs. Most simply, someone could tell a child which groups are preferred and of the highest status. But even in the absence of explicit verbal statements, research suggests children attend to subtler elements of the verbal input they receive. For instance, children attend to labels and generic category language (Foster-Hanson, Leslie, & Rhodes, 2016; Gelman & Roberts, 2017; LaTourrette & Waxman, 2019; Rhodes, Leslie, Bianchi, & Chalik,

2017; Rhodes, Leslie, Saunders, Dunham, & Cimpian, 2017), which directs their attention to which groups are present and important in the world.

Children also make their own observations of the world and of people's interactions in it, including attending to nonverbal cues that can provide evidence of social relationships. Research demonstrates that children attend to non-verbal information about status in at least two domains: their attention to the number of resources that people have, and their perception of others' interpersonal behaviors and interactions. For instance, preschool-aged children infer who is in charge based on observing agents' relative number of resources, age, decision-making power, and physical dominance (Charafeddine et al., 2015), and children make inferences about wealth based on others' material possessions (Olson, Shutts, Kinzler, & Weisman, 2012). Indeed, even infants think resource distributions will mirror patterns of social dominance (Enright, Gweon, & Sommerville, 2017), expecting more dominant individuals to have more resources. Observations of resources thus guide children's thinking about an individual's social status, and children can use similar information about resources to make inferences about social groups. For instance, as early as age 3, children in South Africa associate high status racial groups with greater wealth (Olson et al., 2012).

Children also attend to non-verbal interpersonal behaviors — using posture to infer status differentials between individuals (Brey & Shutts, 2015) and an agent's body language (e.g., leaning toward vs. away) and expressions (e.g., smiling vs. scowling) during social interactions to infer their preference for another individual (Castelli, De Dea, & Nesdale, 2008; Skinner, Meltzoff, & Olson, 2017). These non-verbal behaviors also inform inferences about group relations: for instance, children predict that an agent who leans away from and scowls toward an individual dislikes that individual *as well as* other individuals who appear to be in her social

group (Skinner et al., 2017). Collectively, this research demonstrates children's sensitivity to the subtleties of others' behaviors and possessions, which may in turn relay information about different groups' relative social status.

Here, we raise a question about another pattern of behavior children might attend to in the world: the patterns of people's social choices. We define social choices in this context as the people with whom individuals select to engage. The social choices we make are abundant, spanning from who we stand near to who we invite to our houses for dinner. Notably, social choice can include one's own actions—for instance, in the case of a child, who they play with or seek information from—as well other people's actions, which children may observe. Over time, repeated social selection may form meaningful patterns, and children may track both who (or which group) is selected most, and perhaps also who (or which group) is not selected. In this sense, repeated social selections might appear not merely as actions, but as choices driven by a preference for some kinds of individuals over others. If children track these patterns, they might use this information to infer not just who an individual agent likes or prefers, but also which agents or groups hold status and power more broadly in the society.

To encapsulate this real-world relation between people's repeated social selections and group-based inferences, we draw from the cognitive development domain, where prior research demonstrates that preschool-aged children use others' object selection to infer their object preferences (Garvin & Woodward, 2015; Kushnir, Xu, & Wellman, 2010; Ma & Xu, 2011). This research shows that children's inferences from others' selection depend on whether the pattern of selection appears non-random. Imagine that an agent repeatedly selects objects from a box containing only that kind of object. Here, it is unclear whether the selected object is liked or if it is selected because it is the only kind of object available. In contrast, if one kind of object is

repeatedly selected from a box containing primarily a different kind of object, the selection now seems more like a choice — deliberate, and perhaps indicative of a preference for that object over the other kind of object present. When shown these two scenarios, children reason in the following way: when a rare object is selected, children view the selection as indicative of a preference, but when a common item is selected, they do not (Garvin & Woodward, 2015; Ma & Xu, 2011). Thus, object selection communicates object preferences when the pattern of selection appears non-random.

But critically, children do not make observations in a vacuum; rather, children’s observations are shaped by the social context in which they occur (e.g., Pesowski, Denison, & Friedman, 2016). In the case of objects, one contextual cue that has been shown to be especially important is the linguistic framing about emotions that children hear before viewing an agent’s selections. In one study, children either heard that some toys “make the puppet happy,” or heard that some toys the puppet “always gets.” Children reliably inferred that the puppet preferred the kind of object she selected when they had received the former, but not the latter, verbal framing (Garvin & Woodward, 2015). This suggests that young children must be aware that the agent’s selections are being made in a context in which one is likely to hold preferences.

Our first aim in the present study was to borrow methodology from these past studies using object selection to ask whether selection of other *social* agents (i.e., social choices) can lead children to reason about others’ *social* preferences. In doing so, we wondered whether the kind of linguistic framing described above might not be necessary for children to view social selections as preference-laden choices. The selection of other social agents may inherently suggest a preference: selecting a friend may necessarily indicate a choice of one friend over another in a way that selecting an object does not. Thus, we predicted that children would infer

an agents' social preferences from its selection of social agents even in a context without the strong emotional scaffolding that was required to elicit inferences about object preferences in related work (Garvin & Woodward, 2015; Kushnir, Xu, & Wellman, 2010).

Our second aim was to further probe the range of inferences—beyond just those involving preferences—that children make about others' social choices. Specifically, we were interested in the extent to which children view groups as different in status based on their numerical proportions and their past history of being selected by a third-party agent. Recall that all participants viewed two groups of cats, one that was numerically larger and one that was numerically smaller. When asked which group holds status, one possibility is that children will always see the numerically larger group as more powerful. Such a finding would fit with recent research suggesting that as early as infancy, children see larger individuals and more numerous groups as holding more power (Pun et al., 2016; Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011). An alternative prediction—which is informed by the object literature reviewed above—is that the smaller, selected group may be viewed as special. Notably, there are cases in the real world in which a small, elite group holds power over the larger majority. Given that we provide children with information about both group size and also a third-party's preference, we predicted that in this context, children would predict that the smaller, selected group was highest in status.

We made two central predictions: First, we predicted that, in the absence of verbal framing about emotions, children would only view an agents' item selections as preference-laden choices if the items were framed as social agents (i.e., “friends”) and the items were selected from the smaller (but not the larger) social group. Second, we predicted that children within this condition (i.e., friends chosen from the smaller group) would also view an agent from this numerically smaller—yet repeatedly chosen—group as higher in status.

## Experiment

We presented children with a selection paradigm (e.g., as in Kushnir, Xu, & Wellman, 2010) in the absence of explicit framing about emotions (akin to Garvin & Woodward, 2015) in which a puppet repeatedly selects items belonging to one of two groups (blue versus red cats) from a clear box. Drawing from past findings, we predicted that children would only interpret the puppet's repeated selections as indicative of preference when the puppet's selections were social and appeared non-random (i.e., from a smaller numerical group). We compared this case to social selections from the majority group, and unframed objects selection from the majority and minority groups. Thus, children received either Social Framing, where we described the items as “friends” and stood them up to appear more agentic; or Object Framing, where we described the items as “toys” and laid them flat to appear less agentic. For half of participants in each framing type, the selected group comprised the majority of items in the box (82% of toy cats present); and for half of participants, the selected group comprised a minority of items in the box (18% of toy cats present). After watching the puppet repeatedly select items from one of the two groups, we asked participants to predict which friend or toy the puppet would play with when it returned: one from the selected group, one from the unselected group, or one from a group they received no information about. We asked “who will X play with?” as a more subtly-framed version of the standard preference question from prior work (“Who does X like?”).

Next, to further explore the scope of children's reasoning about inferred social preferences, we asked children who received the social framing additional questions examining their inferences about the agents' shared preferences and the relative status of the different kinds of friends.

## Method

**Participants.** We recruited 160 preschool-aged children (87 girls,  $M_{age}$  = 54.09 months,  $SD$  = 10.52; range = 35.9 – 82.5 months). Children were randomly assigned to hear Social Framing ( $N$  = 80, 47 girls,  $M_{age}$  = 54.93 months,  $SD$  = 10.05; range = 37.4 – 71.6) or Object Framing ( $N$  = 80, 42 girls,  $M_{age}$  = 53.25 months,  $SD$  = 11.02; range = 35.9 – 82.5). Within each framing, children were randomly assigned to see items selected from a numerical minority group (Minority Item Selected) or to see items selected from a numerical majority group. This resulted in a 2 x 2 design with 40 children in each of four selection types: *Social Minority Item Selected* ( $M_{age}$  = 55.22;  $SD$  = 10.01; range = 37.4 – 71.3); *Social Majority Item Selected* ( $M_{age}$  = 54.64 months;  $SD$  = 10.12; range = 38.6 – 71.6 months); *Object Minority Item Selected* ( $M_{age}$  = 52.40;  $SD$  = 9.50; range = 35.9 – 70.7); and *Object Majority Item Selected* ( $M_{age}$  = 54.10;  $SD$  = 12.41; range = 37.8 – 82.5). Six additional children were tested but not included in the final sample due to experimenter error ( $N$  = 2), failure to complete the study ( $N$  = 2), clinical diagnosis ( $N$  = 1), and sibling interference ( $N$  = 1). Children were tested in a quiet room in the laboratory, children's museum, or school. Demographic information was provided for 68% of children. Of those for whom this information was provided, 83% were White/European American, 3% were Asian or Asian American, 2% were Black/African American, 1% were Hispanic/Latino, and 10% reported being Other.

**Materials.** Materials included a plush raccoon hand puppet (30.5 cm tall); three kinds of Calico Critter cat figurines (5.7 cm tall) outfitted with shirts varying in color (red, green, or blue) (see Figure 1); and a clear, plastic box (33 cm by 18cm by 23cm). Two of the kinds of cats (brown fur with red shirts; grey fur with blue shirts) comprised the box's contents, such that one kind comprised the majority of the box's contents (82%; 31 of 38 figures) and one kind

comprised the minority of the box’s contents (18%; 7 of 38 figures) (depicted in Figure 2). We used these percentages since they were the same as used in past studies with this method exploring object choices (e.g., Garvin & Woodward, 2015; Kushnir, Xu, & Wellman, 2010). The colors of the majority and minority groups were counterbalanced across participants and conditions. A third kind of cat (white fur with green shirts) was introduced during familiarization and again at test. On any given trial, testing included 32 of the majority item, eight of the minority item, and one control item.



**Figure 1.** The three kinds of items. In the Social Framing conditions (Left) the three items are described as “friends” and presented standing up to appear more agentic. In the Object Framing conditions (Right), the three items are described as “toys” and presented lying flat to appear less agentic.

**Procedure. Familiarization.** The research procedure received approval from the Cornell University Institutional Review Board (Protocol #1611006763A003, “Development of Social Cognition”). Children sat across from an experimenter, who introduced them to “Raccoon,” a plush raccoon hand-puppet. Children were shown three kinds of “friends”<sup>1</sup> (*Social Framing*) or “toys” (*Object Framing*) in Raccoon’s town. The three items were presented in all six possible

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<sup>1</sup> Among our sample, the term “friend” is used frequently when linguistically marking individuals in an environment (e.g., in a preschool classroom). Thus, for the children tested, the term is a relatively neutral social group marker.

color orders, counterbalanced across participants and conditions (i.e., the chosen item appeared on the left, right and center an equal number of times). In the Social Framing conditions, the items were presented sitting upright and children were told that “different kinds of friends live in Raccoon’s town.” Children heard that each kind of friend has a different color fur and wears a different color shirt (e.g., “Some of the kinds of friends have brown fur and wear red shirts, like this”). In the Object Framing conditions, items were presented lying down and children were told that “different kinds of toys are in Raccoon’s town.” Children heard that each kind of toy is two colors (e.g., “Some of the kinds of toys are brown and red, like this”) (see Figure 1). After learning about the three items, children were told that Raccoon wanted to play, and that he would now choose some friends/toys from the box to play with.

***Selection phase.*** After removing the friends/toys from the table, the experimenter presented a clear box filled with two kinds of friends/toys, as described above (see Figure 2). The third kind of friend/toy did not appear in the box, such that children received no information about this group (defined as the *Novel group*). Children were asked to look through the box so as to familiarize them with its contents. Then, Raccoon reappeared and children were asked to help the experimenter ask Raccoon if he was ready to select some friends/toys from the box. Raccoon then sequentially selected five of the same kind of item from the box, such that the selected item (defined as the *Selected group*) was either from the numerical majority or the numerical minority. The other item present in the box was never selected (defined as the *Unselected group*). After Raccoon selected five items from the box, the experimenter reiterated that Raccoon now had some friends/toys to play with and Raccoon briefly held the items. All materials were then removed from the table.



**Figure 2.** The clear box shown to participants during the choice phase. The box is comprised of two kinds of items, one that makes up the majority of the box’s contents (here, red) and one that makes up the minority of the box’s contents (here, blue). The colors of the majority/minority were counterbalanced across participants.

*Initial questions asked of all participants. Play questions (agent’s preference).* One item from each of the three groups (the selected group, the unselected group, and the novel group) was placed on the table. Order of placement was yoked to the order used during familiarization. Raccoon then appeared from beneath the table and children were told: “Look! Raccoon is back, and he wants to play!” and were asked: “Who (*Social Framing*)/Which (*Object Framing*) do you think Raccoon will play with?” If children did not immediately respond, they were prompted a second time. After, Raccoon disappeared beneath the table again and returned once more. Children were asked to predict “Who/Which Raccoon will play with this time.”

*Home question (own preference).* Finally, all children were asked which of the three friends/toys they would want to take home with them if given the opportunity.

*Follow-up questions asked in social framing conditions.* We next furthered our exploration of social choices to probe some social-specific questions about the three friends and Raccoon's relation to them. The following questions were asked only of children in the two social framing conditions.

*Preference matching yes/no questions.* We first examined whether children thought the Raccoon shared other preferences with the friend group (i.e., color) he had selected. Specifically, we told children about food preferences. We did so given evidence that even infants use social group affiliation to reason about food preference (Lieberman, Woodward, Sullivan, & Kinzler, 2016). We told children that each group of friends likes one kind of fruit (pineapples, plums or apricots), and yoked the order of introduction to the order used during familiarization and test; the fruits were introduced in a fixed order such that, across children and conditions, each friend group was matched with each fruit an equal number of times. After learning about each friend-fruit pairing, children were asked if they thought Raccoon would also like that kind of fruit.

*Preference matching contrast questions.* Next, children were given two forced-choice contrasts and asked which fruit they think Raccoon prefers: (1) the fruit liked by the chosen group vs. the fruit liked by the not-chosen group; and (2) the fruit liked by the not-chosen group vs. the fruit liked by the novel group.

*Identity question.* We next asked children which kind of friend they think the puppet is most like by pointing to each critter and asking "Is Raccoon this kind of friend, this kind of friend, or this kind of friend?"

*Status question.* Last, we examined whether inferences about social preference would guide children's thinking about status. Children were told that one kind of friend is the leader—they are in charge and make all the decisions for the other friends. Children were asked to

indicate which kind of friend they think is the leader: the selected friend, the unselected friend, or the novel friend.

Full text of all questions is provided in Tables 1a and 1b.

<b>1a. Questions asked of all participants.</b>	
<b>Play question (agent's preference)</b>	1a) Who will Raccoon play with? 1b) Who will Raccoon play with this time?
<b>Home question (own preference)</b>	2) Which friend / toy would you want to take home?
<b>1b. Follow-up questions asked of Social Framing participants.</b>	
<b>Preference matching yes/no questions</b>	3a) Do you think Raccoon likes this fruit? (fruit preferred by chosen friend) 3b) Do you think Raccoon likes this fruit? (fruit preferred by not-chosen friend) 3c) Do you think Raccoon likes this fruit? (fruit preferred by novel friend)
<b>Preference matching contrast questions</b>	4a) Which fruit do you think Raccoon likes more? (fruit preferred by chosen friend vs. not-chosen friend) 4b) Which fruit do you think Raccoon likes more? (fruit preferred by not-chosen friend vs. novel friend)
<b>Identity question</b>	5) Which kind of friend do you think Raccoon is?
<b>Leader question</b>	6) Which kind of friend do you think is the leader and makes the choices for the other friends?

**Table 1a and 1b.** Table 1a includes questions asked of all participants. Table 1b includes the follow-up questions asked of participants who received the Social Framing. Questions 3a - 3c and 4a - 4b were counterbalanced.

## Results

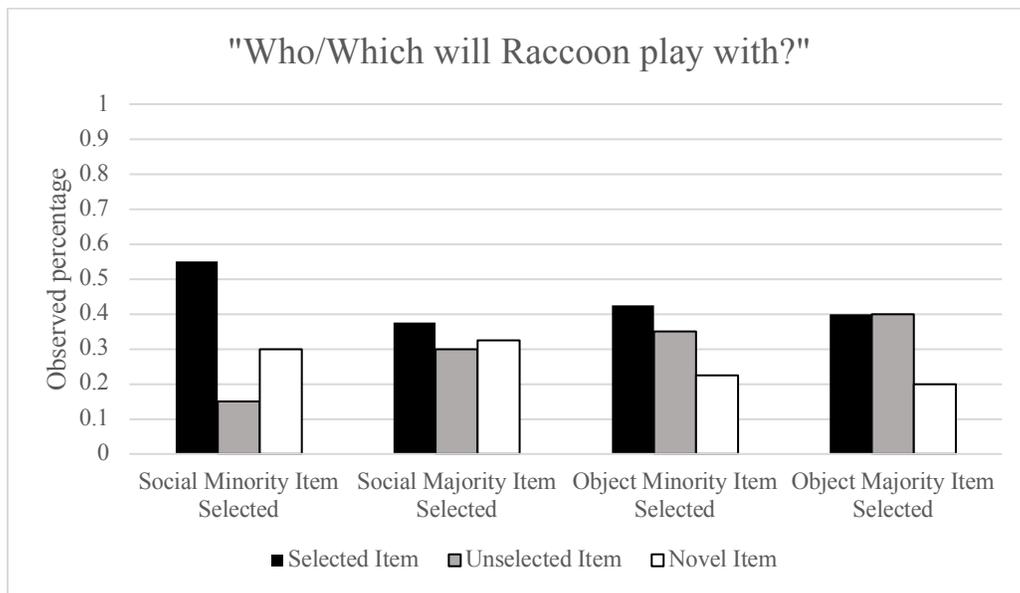
We present results below in the order that questions were asked. First, we present results from the questions we asked of all participants. Next, we present results from the second series of questions we asked of only participants who received the Social Framing. Multinomial logistic regression analyses revealed no significant effect of gender, age, the color selected, or the order of item presentation on children's responses, so we did not consider these factors in the following analyses.

**Questions asked of all participants. *Play question (agent's preference).*** In the absence of verbal framing about emotions, we predicted that children would only interpret an agent's selections as communicating a preference if the selections were social and made from a smaller group. Indeed, we predicted that the three other selection types would *not* lead children to reason about the agent's preferences (replicating past work).

On the first play question (Question 1a, Table 1a), given that there are three possible responses, chance performance is 33%. Fifty-five percent of children responded that the puppet would play with the selected item in the Social Minority Item Selected scenario; 37.5% made this selection in the Social Majority Item Selected scenario; 42.5% made this selection in the Object Minority Item Selected scenario; and 40% made this selection in the Object Majority Item Selected scenario (see Figure 3). The percentage of children responding that the puppet would play with the previously selected item differed from chance in only the Social Minority Item Selected scenario, Binomial Exact  $p$ -value = 0.006, 95% CI = [0.38, 0.71], all other  $p$ 's > 0.24.

To further examine the distribution of responses within each selection type, we constructed a multinomial logistic regression using R's `nnet` package, with children's response to the play question as the outcome variable and selection type as the predictor variable. Post-hoc

comparisons between responses were estimated using the emmeans package. This allowed us to explore contrasting rates of responding to the play question between items (e.g., selected versus unselected item). The overall effect of selection type was not significant,  $\chi^2(6) = 8.428, p = 0.208$ . Of interest to us, however, was whether children treated the selected item differently than the unselected item within these selection types. Only when friends were selected from the smaller group (Minority Item Selected) were children more likely to say the agent would play with the selected compared to the unselected item,  $t(8) = 3.443, SE = 0.12$  corrected,  $p = 0.021$  (see Figure 3). Indeed, these children responded to the play question with the unselected item at below-chance levels, Binomial Exact  $p = 0.017, 95\% CI = [0.057, 0.30]$ .



**Figure 3.** The observed percentage of children responding that Raccoon would play with the selected item (depicted in black), unselected item (depicted in grey), and novel item (depicted in white) in the four selection types: Friend Minority Item Selected, Friend Majority Item Selected, Object Minority Item Selected, and Object Majority Item Selected.

We analyzed children's responses to the second play question (Question 1b, Table 1a) in the same way. On this second play question, children were no more likely to say that the agent would play with any item over the others, all  $p$ 's  $> .25$ . In other words, children did not seem to reliably make predictions about this second choice. In fact, children seemed to treat this question as evidence that their initial response was wrong or no longer relevant: only 10 of the 160 children tested said that Raccoon would play with the same item on both play questions and the two questions were strongly negatively correlated, Cramer's  $V = 0.41$  (See Appendix, Table 1).

***Home question (own preference).*** We asked children which item they would want to take home, given the chance (Question 2, Table 1a). Since there were again three possible responses to this question, chance performance is 33%. Forty percent of children in the Social Minority Item selection type selected the chosen item, 20% did so in the Social Majority selection type, 28% did so in the Object Minority selection type, and 30% did so in the Object Minority selection type. Overall, children themselves did not significantly prefer any one item over the others, all  $p$ 's  $> 0.05$ . However, children's response to the home question was strongly positively correlated with their response to the first play question (and not the second play question), Cramer's  $V = .34$  (See Appendix, Table 2). Regardless of which item children said that Raccoon would play with, children were more likely to also want to take this friend/toy home themselves.

***Follow-up questions asked of social framing participants. Preference matching yes/no questions.*** We asked children whether the Raccoon would share a preference held by each of the three kinds of friends (Questions 3a-3c, Table 1b). Overall, children had a bias towards a "yes" response on these three questions; they were more likely than not to predict that the puppet would like the fruits we told them about, regardless of which friend was the target of the question

(overall, 68% responded “yes”). We compared the response on each question to chance (50%), using two-tailed binomial tests. Full results are depicted in the first three columns of Table 2. Notably, children’s bias to think Raccoon would prefer the target fruit was lowest when asked about the unselected friend in the Social Minority condition (not different from chance,  $p = 0.27$ , 95% CI = [0.43, 0.75]). This pattern contrasts with the Social Majority condition, in which children responded that the puppet would share the unselected friend’s food preference ( $p = 0.01$ , 95% CI = [0.54, 0.85]).

	Preference matching yes/no <i>Chance = 50%</i>			Preference matching contrast <i>Chance = 50%</i>		Identity <i>Chance = 33%</i>
	3a) Selected Friend Preference	3b) Unselected Friend Preference	3c) Novel Friend Preference	4a) Selected vs. Unselected	4b) Unselected vs. Novel	5) Identity
<b>Social Minority</b>	78% (yes)	60% (yes)	68% (yes)	70% (chosen)	60% (novel)	47.5% (chosen)
<b>Social Majority</b>	67% (yes)	71% (yes)	63% (yes)	57% (chosen)	54% (novel)	48.7% (chosen)

**Table 2.** Children’s responses to the preference matching yes/no, preference matching contrast questions, and the identity question asked of children who received the Social Framing. Responses are broken down by selection type (Social Minority Item Selected and Social Majority Item Selected). Shaded boxes represent responses that differ significantly from chance.

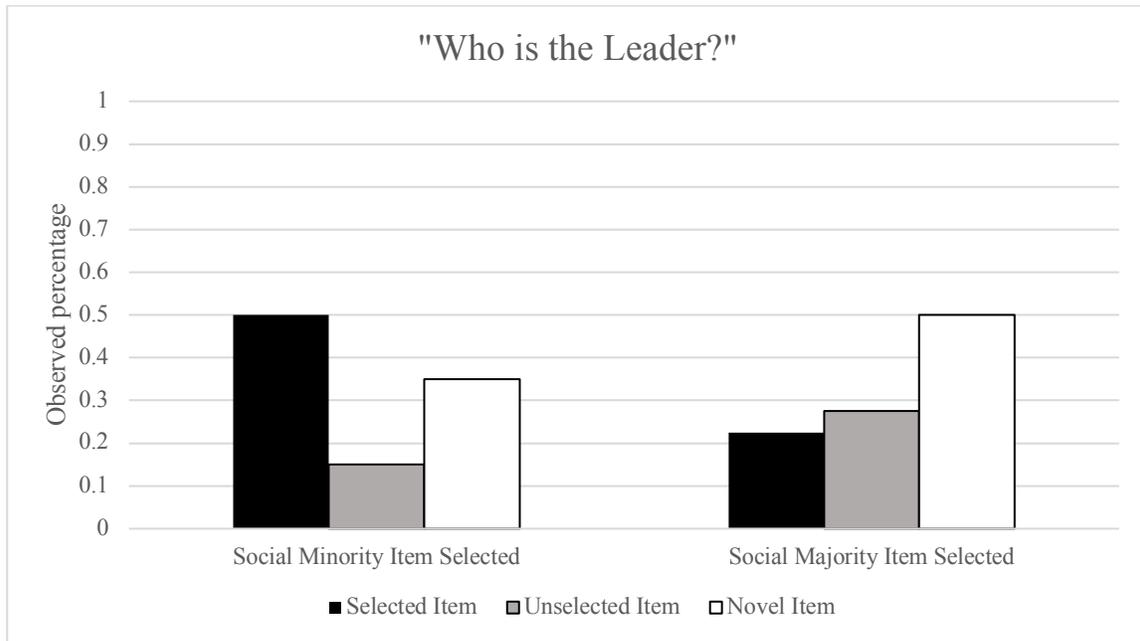
**Preference matching contrast questions.** We asked children whether the puppet would be *more* likely to prefer the fruit liked by (1) the selected friend vs. the unselected friend and (2) the unselected friend vs. the novel friend (Questions 4a-4b, Table 1b). Full results are provided in the fourth and fifth columns of Table 2. Notably, children in the Social Minority selection were significantly more likely to say that Raccoon would like the selected friend’s fruit than to say that Raccoon would like the unselected friends’ fruit,  $p = 0.02$ , 95% CI = [0.53, 0.83]. We wondered how children’s response to the preference matching yes/no questions informed their

response to the preference matching contrast questions. Children's response to the first preference matching question (Selected vs. Unselected) was predicted by whether they thought Raccoon liked the Unselected friend's favorite fruit, Cramer's  $V = 0.2823$  (See Appendix, Table 3). In contrast, children's response to the second preference matching question (Unselected vs. Novel) was predicted by whether children thought Raccoon liked the Novel friend's favorite fruit, Cramer's  $V = 0.23$  (See Appendix, Table 4).

**Identity question.** When asked which kind of friend Raccoon is (Question 5, Table 1b), children were given three possible responses, so chance is again 33%. The modal response in both conditions was the chosen friend (48% in each condition), and this response differed marginally from chance,  $p = 0.063$ . Results are presented in the last column in Table 2.

**Leader question.** Finally, we examined children's response to the leader question (Question 6, Table 1b). Once again, given that there were three possible responses, chance is 33%. In the Social Minority selection, children's modal response was the previously chosen friend (50% of children), and children gave this response significantly more than chance,  $p = .03$ , 95% CI = [0.34, 0.66]. In contrast, in the Social Majority selection, children's modal response was the novel friend (50% of children), and children made this response significantly more than chance,  $p = .03$ , 95% CI = [0.34, 0.66] (see Figure 4). We again constructed a multinomial logistic regression to explore contrasting rates of responding between items on the leader question. Selection type significantly predicted children's response,  $\chi^2(2) = 7.48$ ,  $p = 0.024$ . Critically, children in the Social Minority selection were more likely to say that the previously selected friend was the leader compared to the previously unselected friend,  $t(8) = 3.048$ , SE = 0.11 corrected,  $p = 0.038$ . Again, we wondered whether children's response to the Leader question related to their response to the Play question. Indeed, children's response to these two

questions was positively related (Cramer’s  $V = .28$ ), meaning that regardless of who children said Raccoon would play with, children were more likely to think this individual was also the leader (see Appendix, Table 5).



**Figure 4.** The observed percentage of children who responded that the selected friend (depicted in black), unselected friend (depicted in grey) and novel friend (depicted in white) was the “leader” in the Social Minority Item Selected (Left) and Social Majority Item Selected (Right) selection types.

### Discussion

The central aim of the present study was to test whether children can track others’ social selections to predict others’ social preferences, even in the absence of verbal framing about emotions. Past research indicates that, when provided with adequate verbal framing, young children view agents’ object selections as communicating their object preferences if those selections are made from a smaller group, thus appearing non-random. In the present study, we

provided children with a scenario in which a puppet repeatedly selects the same kind of friend (social selection) or the same kind of toy (object selection) to play with. These selections were made from a numerically over-represented group (such that they appeared potentially random), or a numerically underrepresented group (such that they appeared to be non-random). As previously shown with object selection, we demonstrate that when an agent's pattern of social selections appears non-random (i.e., are made from the smaller group present), children reason that the agent will again play with the kind of friend previously selected in the future. In this sense, children view an agent's non-random social selections as social choices — ones that are indicative of a social preference that will extend into the future.

But there are other ways in which social selection *differs* from object selection, which we uncover in the present study. One way social selection might operate differently from object selection is in the relative necessity of linguistic framing for these selections to appear preferential (i.e., to appear as preference-motivated choices). Critically, we presented an agent's selections in the absence of linguistic framing about emotions and/or preferences. Replicating past work (Garvin & Woodward, 2015), these unframed object selections did not lead children to infer the puppet's object preferences. In contrast, social selections elicited reasoning about preference even in the absence of the linguistic framing used in past studies on object selections (Garvin & Woodward, 2015; Kushnir, Xu, & Wellman, 2010). This finding suggests that social selection might inherently be viewed as indicative of a preference, regardless of whether this connection is explicitly made. We posit that this might reflect a difference in the nature of social and object choice, where the selection of other social agents may carry more weight than the selection of objects.

Another way that social choices appear to operate differently from object choices is with regard to the item that is not chosen. To jump to the punchline, in a social context, choosing and avoiding seem to go hand-in-hand. This is often true in the real world, where choosing one friend/person can at times mean excluding another. In past work involving object selection, children who did not think the agent liked the selected item were split between responding that the agent liked the unselected item and the novel item. The authors took this pattern to indicate that the puppet's object selections communicated its preference for the selected toy, rather than its avoidance of the unselected one (Kushnir, Xu, & Wellman, 2010). In contrast, children in the present study who saw analogous social selections (our Social Minority Item Selected condition) responded that the agent would play with the previously selected friend more than chance, but also responded to this question with the previously unselected friend *below* chance levels, with only 15% of children giving this response. Likewise, children were unlikely to think the puppet would share a food preference with this group, and just 15% of children responded that this kind of friend was the leader. These findings regarding the unselected friend fit with work demonstrating that even young children are highly sensitive to social exclusion (e.g., Hwang, Marrus, Irvin, & Markson, 2017; Killen & Rutland, 2011; Killen, Mulvey, & Hitti, 2013). Importantly, this same pattern concerning the unselected group did not emerge when we provided children with Object Framing in present study (akin to Kushnir, Xu, Wellman, et al., 2010). Thus, in contrast to object selection, when an agents' selections are social, who is not chosen seems to matter just as much as who is.

A third way social choices appear to differ from object choices is that an individual agent's social selection signals not just who this individual agent prefers, but also who might be privileged in a larger social structure. Our second aim in the present study was to explore the

range of inferences, beyond those involving an agent's play preferences, that children make from repeated social selection. We found that children used the observed pattern of social selection to think about shared food preferences, reasoning that the agent would share preferences with the previously selected friend over the previously unselected friend. This finding fits with recent work demonstrating that infants and children reason about others' food preferences (Lieberman, Kinzler, & Woodward, 2014; Liberman et al., 2016) and object preferences (Vélez, Yuerui, & Gweon, 2018) based on social group affiliation. Notably, infants in past work also made this same inference in the reverse, expecting two people to affiliate if they shared food preferences (Lieberman et al., 2016); but children did not infer group affiliation from shared object preferences (Vélez et al., 2018). This discrepancy between reasoning about food and toy preferences aligns with our presents claims about a difference between choices that are social in nature (e.g., here, food) versus those that are object-based (e.g., here, toys). Also, this work raises open questions regarding whether children would expect an agent to choose friends with whom it previously shared a food preference.

Of particular interest to us was our leader question. We asked whether providing children with information about social groups' numerical proportions and their past history of being chosen would lead children to infer status differentials between members of the two groups. We found that children's reasoning about status depended on the size of the group selected. When children witnessed an agent repeatedly select friends from the smaller numerical group, children inferred that a friend from this selected group was the leader. However, when an agent repeatedly selected friends from a larger numerical group, children reasoned that a friend from this third group they never saw the agent interact with was in charge of the others. Notably, children's inferences about the Raccoon puppet's preference predicted their response to the

leader question, suggesting that children's inferences about leadership were informed by their thinking about a third-party agent's preferences.

Notably, in both cases, children reasoned that an agent belonging to a relatively small social group was in charge. Given recent work suggesting that infants reason that individuals from larger social groups are in charge (e.g., Pun et al., 2016), one possibility in the present study was that children would always respond that an agent from the larger group was the leader (i.e., the selected group in the Social Majority condition and the unselected group in the Social Minority condition). In contrast, we demonstrate that when simultaneously provided information about a group's relative size and its past history of being chosen, children make a notably different inference, picking an agent from this small, repeatedly selected group. We propose that the combination of these two pieces of information led children to think about power as pertaining to a group's prestige rather than to their physical dominance (e.g., Henrich & Gil-White, 2001). In line with this interpretation, in the present study, we provided no information to children about intergroup competition or physical conflict, factors that were present in situations yielding inferences about bigger groups being in charge. It is unclear from the present results whether children inferred that one individual was the leader or whether the entire group to which this individual belonged held higher status. Open questions concern the relation between individual power and group power. Future work should also continue exploring the factors that lead children to conceptualize power and status in different ways, and should aim to better understand when children might see individuals from bigger versus smaller groups as holding status.

In sum, though children track statistical patterns of social selection as they do linguistically framed object selection, children's reasoning about others' social and object

choices differs in important ways. First, children use others' social selection to reason about their social preferences even without the verbal framing previously shown to be necessary for reasoning about object selection. Second, social choices seem to carry a dual meaning, simultaneously highlighting who is selected as well as who is not. Third, children use social choices to reason not only about the individual agents selected, but also about broader social structures.

The fact that children reasoned so easily and deeply about the social choices they observed may highlight the impact of people's social choices in the real world. Our goal in using this method was to encapsulate the real-world phenomenon of social choice. Children observe people making social choices every day, and the present findings reveal an important mechanism by which children may come to understand people's social preferences from their social selections. If children track the patterns of others' social selections over time, they might use them to infer not just who an individual agent (i.e., a parent, teacher or friend) likes, but also which social *groups* that person prefers, as well as which social groups hold status in their larger society. If children in the real world track social choices from early in life, this may also help to explain why social attitudes can be difficult to revise later in life, at which point children (or adults) have been exposed to many choice exemplars (e.g., Aboud et al., 2012; Aboud & Skerry, 1984; Gregg & Banaji, 2006; Mann & Ferguson, 2015). More optimistically, better understandings of how social attitudes are formed may also provide insight into potential mechanisms for change, particularly while social attitudes are still being developed. For instance, open questions include whether changing the context in which others' social selections are made, or providing children with counter-examples in which previously unselected individuals *are* selected might help to change previously instantiated attitudes about social preference.

By establishing that social choices operate this way in a lab setting, the present study opens many questions regarding how this mechanism operates outside of the lab. For instance, the present research points to the importance of context in determining whether social selections elicit inferences about preference (i.e., whether a smaller or larger group is selected). One resulting possibility is that certain real-world contexts (e.g., contexts that are more diverse versus segregated, Eason, Kaiser, & Sommerville, 2017) might lead children to see others' social choices as being more preference-laden, or to do so earlier in life.

Other open questions concern more complex patterns of social choice, which are likely to occur in the real world. In the present study, the agent only selects one kind of individual and the agent can only possibly select members from two social groups. One question ripe for future exploration is how children's inferences (both about preference and status) might differ if the agent's selections are more varied, but still biased (e.g., if the agent selects four of one kind of friend and one of another). Past work with infants demonstrates that inconsistency of selection prevents infants from seeing an agents' pattern of selection as preferential choices (Luo, Hennefield, Mou, vanMarle, & Markson, 2017). But given that this work tests infants and only involves object selection, future work might consider cases involving social selection, and test both infants and older children. Another question concerns how children interpret an agents' pattern of selection when more than two groups are present. Both of these questions are critical when considering people's social choices in the real-world, in which there are many social groups and an individual agent's social choices are more likely than not to be variable and inconsistent. For example, an individual might interact with members of many different social groups, and yet over time, the pattern of their choices may still indicate a preference for some individuals/groups over others.

Finally, we began this paper by outlining some of the various inputs through which children could learn about social attitudes. Given that social choices are nonverbal in nature, important questions concern how children interpret nonverbal behaviors (including social choices) in the presence of verbal statements that may provide contrary information. To fully understand how children come to understand the social world, it will be essential to understand how children incorporate various streams of information, especially when they conflict (e.g., if a person says they like both social groups present but only chooses to interact with individuals from one group).

In conclusion, the present research demonstrates that children track others' social selections to predict their social group preferences as well as to reason about social groups' relative status. The present work points to the strong link between social selection and social preference; in contrast to object selection, children view social selection as a choice of one agent over another agent. In the real-world, social choices may similarly indicate agents' preferences and social attitudes, regarding the individuals and groups who are chosen, as well as those who are not.

APPENDIX

		Play Question 1 (“Who will Raccoon play with?”)		
		Selected	Unselected	Novel
Play Question 2	Selected	5	25	18
	Unselected	35	2	21
	Novel	30	21	3

**Table 1.** Cross-tabulation between Play Question 1 and Play Question 2 across all participants. Cramer’s V = - 0.410.

		Play Question 1 (“Who will Raccoon play with?”)		
		Selected	Unselected	Novel
Take Home Question	Selected	32	7	8
	Unselected	10	29	12
	Novel	28	10	22

**Table 2.** Cross-tabulation between Play Question 1 and the Take Home Question across all participants. Cramer’s V = 0.34.

		Does Raccoon like the Unselected friend’s preferred fruit?	
		Yes	No
Does Raccoon prefer the fruit liked by the Selected or Unselected friend?	Selected	27 (66%)	22 (82%)
	Unselected	14 (34%)	5 (18%)

**Table 3.** Cross-tabulation between Question 3b (Unselected friend matching question) and Question 4a (Selected friend vs. Unselected friend contrast question) asked of participants who

received Social Framing. Cramer's  $V = 0.28$ .

		Does Raccoon like the Novel friend's preferred fruit?	
		Yes	No
Does Raccoon prefer the fruit liked by the Unselected or Novel friend?	Novel	31 (65%)	11 (41%)
	Unselected	17 (35%)	16 (59%)

**Table 4.** Cross-tabulation between Question 3c (Novel friend matching question) and Question 4b (Unselected friend vs. Novel friend contrast question) asked of participants who received Social Framing. Cramer's  $V = 0.23$ .

		Play Question 1 ("Who will Raccoon play with?")		
		Selected	Unselected	Novel
Take Home Question	Selected	18	6	5
	Unselected	7	7	3
	Novel	12	5	17

**Table 5.** Cross-tabulation between Play Question 1 and the Leader question asked of participants who received Social Framing. Cramer's  $V = 0.28$ .

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