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20-month-old Infants Expect Members of a Social Group to Share Preferences

A Thesis submitted in partial satisfaction of the requirements  
for the degree of Master of Arts

in

Psychological Sciences

by

Megan Alyssa Smith

Committee in charge:

Dr. Rose Scott, Chair  
Dr. Jeff Gilger  
Dr. Anne Warlaumont

2015



The thesis of Megan Alyssa Smith is approved, and it is acceptable in quality and form  
for publication on microfilm and electronically:

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## **Abstract**

### **20-month-old Infants Expect Members of a Social Group to Share Preferences**

by Megan Alyssa Smith for the partial satisfaction of the requirements  
for the degree of Master of Arts in Psychological Sciences  
University of California, Merced 2015  
Dr. Rose Scott, Chair

Previous research suggests that older children expect members of social groups to share characteristics. Here, we examined whether 20-month-old infants demonstrate similar stereotype-based reasoning by expecting members of a social group to share preferences. In Experiment 1, infants were first introduced to two arbitrary social groups that were defined by matching costumes and labels. In the next three trials, infants saw a member of one of the social groups (a Topid) choose between two foods. In the test trial, infants saw either a member of the same social group (another Topid) or a member of a different social group (a Brinko) choose the same food as the previous Topid, or a different food. Infants looked reliably longer when members of the same social group picked different foods compared to when they picked the same foods. In contrast, infants who saw a member of a different group in the test trial looked equally regardless of which food the individual selected. These results suggest that infants expected members of the same, but not different, social groups to share preferences.

Experiment 2 replicated the findings from the same-group condition and extended them to social groups that were labeled with adjectives instead of nouns, which suggests that noun labels were not necessary for infants to form stereotyped beliefs about the groups. These findings provide new evidence that infants as young as 20 months demonstrate stereotype-based reasoning about novel social groups.



## Chapter 1: Introduction

Forming categories is vital to cognition. People often assume that categories share inherent characteristics that remain stable over time (e.g., Medin, Wattenmaker, & Hampson, 1987; Murphy & Medin, 1985), and this allows us to draw rich inferences about novel category members. However, treating social groups as natural kinds can result in inferring deep essential qualities based on appearance, treating independent categories as if they are mutually exclusive, and treating arbitrary categories as if they have deep meaning (e.g., Gelman, 1992; Gelman & Markman, 1986, 1987; Hirschfeld, 1996; Prentice & Miller, 2007; Rhodes & Gelman, 2009; Rhodes, Leslie, & Tworek, 2012; Rothbart & Taylor, 1992). Thus, when categorization is applied to social domains, it can have a pernicious influence, giving rise to prejudice and stereotypes. Therefore, it is important to understand when and how social categories and stereotyped beliefs emerge in infancy. The present research examines when infants first expect members of a social group to share stable characteristics.

Considerable evidence suggests that by the preschool years the tendency to view social categories as natural kinds with rich inductive potential is well established (Bélanger & Hall, 2006; Bigler, Jones, & Lobliner, 1997; Diesendruck & haLevi, 2006; Ford & Stangor, 1992; Hirschfeld, 1996; Rothbart & Taylor, 1992; Taylor, 1996; Waxman, 2013). Already by 3- to 4-years of age, children spontaneously group social agents into categories and expect category members to be similar to one another but dissimilar from others (Bélanger & Hall, 2006; Bigler, Jones & Lobliner, 1997). For instance, when 4- to 5-year-old children were provided labels denoting others' ethnicity, children inferred that a target member of a labeled category would share biological properties such as blood type, and psychological properties such as wanting to be a "Nagim" when he/she grew up, with the other category members (Birnbaum, Deeb, Segall, Ben-Eliyahu, & Diesendruck, 2010). Work by Shutts and colleagues suggests that 3-year-old children used gender similarity between themselves and others to decide who they would like to be friends with, as well as to determine which children would share their own preferences for social activities (Shutts, Roben, & Spelke, 2013). Unlike 3-year olds, 4-year-olds used both gender and racial category membership to guide their inferences (Shutts, Roben, & Spelke, 2013).

Furthermore, work by Kalish (2012) has demonstrated that young children have the tendency to misremember preferences as social norms. Children were first introduced to individual-A. Individual-A was labeled with either a proper name (e.g., Lisa) or with a novel category label (e.g., a Lissian). Then, children were told that individual-A selected an object. Individual-A's selection was either motivated by a social norm or by the individual's preference. Children were then asked to predict which object a new individual, individual-B, would select. Later in the experiment, children were asked to recall what they learned about individual-A earlier in the study. Specifically, children were asked whether individual-A made a selection based on a preference or a social norm. Children who had previously generalized a preference across members of a novel category (i.e. they expected a second Lissian to like the same object as the first Lissian), misremembered learning about norms when they had actually learned about a target's preferences. In other words, when children heard about individual-A's likes and dislikes,

children tended to remember having learned about what individual-A was or was not allowed to do because of social norms (Kalish, 2012). This suggests that when social categories are primed, individuals may treat characteristics such as preferences as true of the entire category, and this then affects what individuals remember about category members.

Another example of how children and adults' inferences are guided by group membership is children's understanding and use of generic statements. A generic statement expresses generalizations about entire kinds (e.g., "Bears eat ants"). In contrast, a nongeneric statement expresses facts about specific individuals (e.g., "This bear eats ants"). When children are presented with generic statements they assume the given property is true of other members of the category. For example, if told, "Pagons are friendly," children will assume that other Pagons will be friendly as well (Chambers, Graham, & Turner, 2008). Even when provided with an exception case to this generic statement (i.e. "Except this Pagon. This Pagon isn't friendly), 2- to 3-year olds continued to generalize properties to subsequent characters (Chambers, Graham, & Turner, 2008). Adults also understand that a property doesn't need to be highly prevalent within a category in order to be generically true (Cimpian, Brandone, & Gelman, 2010). For example, it is generically true to say that "mosquitoes carry the West Nile virus", although fewer than 1% of mosquitoes actually do. Generic statements are powerful enough to cause children and adults to disregard statistical evidence, and this influences children and adults' inferences about members of a social category (Cimpian, Brandone, & Gelman, 2010).

When and how does this tendency to view social categories as natural kinds emerge? There is evidence to suggest the capacity to notice group membership has its roots in infancy. As early as 3 months, infants notice visual and audible features associated with group membership and use them to spontaneously categorize others as similar or dissimilar to themselves (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Dunham, Baron, & Banaji, 2008; Ferguson et al., 2009; Kelly et al., 2005, 2007; Kinzler, Dupoux, & Spelke, 2007; Kinzler, Shutts, & Correll, 2010; Kinzler & Spelke, 2011; Shutts, Kinzler, McKee, & Spelke, 2009; Quinn et al., 2002, 2008). For example, 3-month-old infants preferentially attend to faces from their own racial group (Kelly et al., 2005). Infants also demonstrate biases based on audible attributes such as language and accent. Six-month-old infants prefer to look at a person who previously spoke in their native language to those who spoke in a foreign language, and 5- to 6-month-old infants prefer to attend to a speaker with a native accent, over a speaker with a foreign accent (Kinzler, Dupoux, & Spelke, 2007). Additionally, 10-month-old infants are more likely to accept toys from a person who spoke their native language and 12-month-old infants are more likely to select foods previously endorsed by a speaker of their native language (Kinzler, Dupoux, & Spelke, 2007; Shutts, Kinzler, McKee, & Spelke, 2009). Thus, prelinguistic infants use accent and language as markers of similarity to themselves.

In addition to visual and audible attributes, infants categorize others as similar/dissimilar to themselves based on their preferences (Hamlin, Mahajan, Liberman & Wynn, 2012; Mahajan & Wynn, 2012). In work by Hamlin, Mahajan, Liberman, and Wynn (2012), 9- and 14-month old infants' preferences for graham crackers versus green beans were established by having them choose between the foods. Then, infants were

shown a puppet show in which two rabbit puppets indicated their own food preferences by expressing positive affect toward one food and negative affect towards the other. The similar puppet always preferred the same food as the infant, and the dissimilar puppet always preferred the other type of food. Infants then watched another puppet show where either the similar puppet or dissimilar puppet starred as the target. The target repeatedly bounced a ball and accidentally dropped it causing it to bounce toward one of two dog puppets. On alternating events, the helper dog puppet returned the ball to the target or the harmer dog puppet took the ball and ran away with it. Finally, infants were presented with the helper and harmer puppets and each infant's preference for the helper versus the harmer was determined by which puppet the infant first contacted with a visually guided reach. Infants who saw interactions involving the similar rabbit preferred the helper dog puppet over the harmer dog puppet, whereas infants who saw interactions involving the dissimilar rabbit puppet preferred the harmer dog puppet over the helper dog puppet. In a second experiment, infants' preferences for harmful and helpful versus neutral individuals were examined using the same methods as previously described. Whereas 14-month-olds preferred characters that were more helpful to similar targets and characters that were more harmful to dissimilar targets over a neutral character, 9-month-old infants showed no such preference (Hamlin, Mahajan, Liberman, & Wynn, 2012). Thus, by the first year of life, infants prefer those who are similar to them and dislike those who are different, and this pattern becomes more robust with age.

However, these studies do not demonstrate that infants can spontaneously categorize individuals as members of a social group. There is some evidence that by 12 months infants begin to reason about social groups rather than merely reasoning that they are similar or dissimilar to others (Rhodes, Hetherington, Brink, & Wellman, in press; Liberman, Woodward, & Kinzler, 2015; Powell & Spelke, 2013; Sloane, Baillargeon, & Premack, 2013). In a violation-of-expectation paradigm by Powell and Spelke (2013), 12-month-old infants were shown two groups of identical figures, one consisting of three orange stars and the other of three purple trapezoids. Initially, the figures composing each group appeared in close proximity to one another. Then, the figures in each group performed a series of synchronized, small, semicircular movements around a larger, circular path. After this introductory sequence, the orange stars spread out horizontally on one side of the screen and the purple trapezoids on the other. Infants then saw three rounds of familiarization and test trials. In each of the familiarization trials, one figure moved toward and landed on a platform at the center of the screen and then either jumped up and down or slid back and forth three times, according to its group membership. In the test trials, the remaining figures that hadn't yet acted, one from each group, performed the same actions. Half of the infants saw both figures jump, whereas half saw both slide. Thus, for one figure the action matched that of its group whereas for the other figure the action was different from that of its group. Infants looked longer in the test trial if the target figure performed an action that was inconsistent with its group members (e.g. in familiarization the trapezoids slid and in the test trial the trapezoid jumped), suggesting they expected the target figure to behave like its group members.

Additionally, infants use social relationships to form expectations about how individuals will respond to foods (Liberman, Woodward, & Kinzler, 2015). Thirteen- to fifteen-month-olds watched a series of videos in which a pair of actors expressed their

preference for foods. In the first trial, the two actors either interacted positively by smiling and waving toward one another, or interacted negatively by turning away from one another and crossing their arms. In the next three trials, the two actors sat at a table with the two foods in front of them. The first actor expressed her preference for one of two foods by either emoting positively (i.e., saying “Mmmm” and smiling) or emoting negatively (i.e., saying “Yuck” and looking disgusted). Then, infants saw six alternating test trials in which infants either saw the second actor like each food, or saw the second actor dislike each food. If the actors were previously affiliative, infants expected the second actor to share the same food preference as the first actor and were surprised when she did not. If the actors had previously disengaged, infants did not expect the second actor to share the same food preference as the first actor and were surprised when she did (Lieberman, Woodward, & Kinzler, 2015).

Both of the experiments just described (i.e. Powell & Spelke, 2013; Lieberman, Woodward, & Kinzler, 2015) suggest that infants can reason about social categories that they themselves are not members of. However, in both cases the target character acted in the presence of its group members. Infants may have merely expected the target character to conform to social pressures or imitate its group members and were surprised when they did not. Thus, it remains unclear the age at which infants expect members of a social category will share inherent characteristics and behaviors that remain stable over time.

In the present research, we examined whether 20-month-old infants expect members of a social group to share stable characteristics. Specifically, we investigated this question in the context of preferences. Infants can reason about goals and preferences from an early age (e.g., Buresh & Woodward, 2007; Luo & Baillargeon, 2005a; Martin, Onishi, & Vouloumanos, 2012; Schlottmann, Ray, & Surian, 2012; Shimizu & Johnson, 2004; Sommerville, Woodward, & Needham, 2004; Spaepen & Spelke, 2007; Woodward, 1998, 1999). A series of seminal studies by Woodward (1998, 1999) demonstrated that infants attribute goals to human agents and expect the agent to maintain their goal in future actions. In a classic paradigm, Woodward (1998) showed 5-, 6-, and 9-month-old infants a hand that repeatedly reached for object-A instead of object-B. In the test trial, the positions of the toys were reversed and the hand reached for either object-A or object-B. Infants looked longer if the hand reached for object-B, suggesting that during habituation the infants had attributed to the hand a preference for object-A and expected it to reach there as it hand done in the past. Further work demonstrated that infants were actually attributing to the agent a preference for the target toy and expected her preference to remain stable in the test trials (e.g., Biro, Verschoor & Coenen, 2011; Luo & Baillargeon, 2005a; Robson & Kuhlmeier, 2013; Song, Baillargeon, & Fisher, 2013). Infants also expect preferences to be agent-specific (e.g., Buresh & Woodward, 2007; Egyed, Király, & Gergely, 2013; Henderson & Woodward, 2012). In a violation of expectation paradigm by Buresh and Woodward (2007), 13-month-old infants were shown an agent who had a preference for a particular toy. When infants were later shown a different actor, infants looked equally when this new agent chose either toy, demonstrating they did not attribute a preference to the new agent (Buresh & Woodward, 2007). Infants assumed the first agent’s preference was person-specific and that other agents may have different preferences.

However, there are some situations in which infants may generalize preferences across agents. When an agent presents her preference in a communicative context (e.g., gaining the infant's attention or establishing eye contact before presenting the information), infants generalize that preference to another individual. It has been argued that communicatively referencing an object in such a way prompts the infant that the preference displayed is shared cultural knowledge, and that this preference is applicable to other members of a community (Egyed, Király & Gergely, 2013). These experiments demonstrate that infants understand when knowledge may be applicable to other individuals, and in these situations they can generalize information across agents. There is also some evidence that infants expect members of a given natural kind (i.e. all dogs) to share preferences. When 15-month-old infants see an animal pick food-A over food-B, they expect another animal of the same shape (and thus presumably the same kind) to prefer the same food (Setoh & Baillargeon, 2010).

Here, we asked whether 20-month-olds would also generalize a preference based on social group membership. If infants treat social groups as natural kinds, they should expect preferences to be shared among members of a social group, similar to how they expect food preferences to be shared among animals of a given species. Infants were tested in a violation-of-expectation task in which an agent, who belonged to one of two possible arbitrary social groups, demonstrated a preference for a novel food. We focused on food preferences because foods are culturally relevant and thus likely to be shared amongst members of a social group (Cashdan, 1998; Rozin & Siegal, 2003). Infants then saw an agent from either the same or different social group choose between the same two foods. If infants generalize a preference across members of a social group, infants should expect members of the same social group (and not members of a different social group) to pick the same foods, and should be surprised if members of the same social group pick different foods instead.

## Chapter 2: Experiment 1

Infants in Experiment 1 were tested in either the same- or different-group condition. Infants first saw three individuals, two of which wore the same costume and were labeled with the same novel label (see Figure 1). In the same-group condition, two of the individuals labeled themselves as Topids whereas in the different-group condition, two of the individuals labeled themselves as in Brinkos. We used the arbitrary social groups “Topids” and “Brinkos” in order to prevent infants from drawing inferences based on their prior knowledge about social groups (e.g., gender, ethnicity, etc.) and to provide infants with equal amounts of experience with the current social group being tested. The groups were marked by both costumes and labels because previous research with older children suggests that physical appearance alone is not sufficient to establish group membership (Baron, Dunham, Banaji, & Carey, 2014; Diesendruck & Weiss, 2015).

After being introduced to the social groups, infants saw three familiarization trials in which a member of one of the social groups (a Topid) chose between two foods, expressed approval by saying “Mmm!”, and displayed positive affect while eating the food. In the test trial, infants saw either a member of the same social group (another Topid) or a member of a different social group (a Brinko) choose a food, eat it while expressing approval and positive affect, and then pause. Infants’ looking time to the paused scene was then measured. Based on prior research (e.g., Diesendruck & HaLevi, 2006; Hirschfeld, 1996; Rothbart & Taylor, 1992; Setoh & Baillargeon, 2010; Taylor, 1996; Waxman, 2013), if infants in the same-group condition treat these arbitrary social groups as “natural kinds,” they will assume that members of the same social group will share preferences, and will look longer when members of the same social group pick different foods instead. Infants in the different-group condition should display a different looking-time pattern. By 18 months, infants expect preferences to be specific to individuals unless given indication otherwise (i.e. communicatively referencing an object; Egyed, Király, & Gergely, 2013). In the current experiment, infants in the different-group condition should not assume that members of different social groups should share food preferences. Thus, infants in the different-group condition should look equally regardless of whether members of different social groups pick the same foods or pick different foods.

### Method

**Participants.** Participants were 36 healthy term infants, 18 male and 18 female (ages 18 months, 9 days to 22 months, 0 days). Another 13 infants were tested but excluded because they became fussy (7), because they were highly active in all trials (1), because of parental interference (2), because their looking time in test was over 2.5 standard deviations above the mean of their condition (2). Half the infants were randomly assigned to the same-group condition ( $M = 20$  months, 18 days) and half to the different-group condition ( $M = 19$  months, 25 days).

The infants’ names in this and the following experiment were obtained from birth records provided by the California Department of Public Health, as well as from a database of parents who had previously expressed interest in participating in research studies with their children. Parents were offered reimbursement for their transportation expenses, and their infant was given a small gift (book or t-shirt) for participating. The racial and ethnic composition of the infants analyzed in this report was 60% Caucasian,

4% Asian, 2% American Indian or Alaska Native; an additional 8% chose ‘other race’, 20% selected more than one race, and 6% chose not to respond. 43% of the sample identified as Hispanic or Latino, 55% identified as not Hispanic or Latino, and 2% chose not to respond. In lieu of income information, we recorded the highest level of education reported by either parent: 2% completed less than high school, 35% completed high school, 16% completed an Associate’s Degree, 27% completed a Bachelor’s degree, 14% completed a Master’s degree, and 6% completed a Doctoral degree.

**Stimuli.** Stimuli consisted of digitized high definition video recordings of actors performing a series of actions. All infants saw four familiarization trials and one test trial. A separate video was played for each trial. Each trial consisted of an initial phase followed by a final phase. The duration of the initial phase was fixed and identical for all participants. The duration of the final phase was infant-controlled. All trials are described from the infants’ perspective.

**Same-group familiarization trials.** At the start of the first familiarization trial, three female actors sat around a table (see Figure 1). The female actor to the left of the table (Topid-A) wore a pink turtleneck and a yellow visor that had a white, green, and orange pipe cleaner attached to the bill. A second female actor sat centered behind the table (Topid-B) and wore an identical costume to Topid-A. The female actor to the right of the table (Brinko-A) wore a yellow and gray plaid, long-sleeved shirt and a red cap with a propeller attached to the top. Actors that looked dissimilar on multiple features (i.e., different hair colors, hair styles, etc.) were selected to make it easier for infants to discriminate between them.

All actors began the trial with their heads down. During the 10-s initial phase of the trial, the actors first looked up and looked at one another. Then, Topid-A said “Hi, I’m a Topid.” Topid-B said, “Hi, I’m a Topid too.” Finally, Brinko-B said, “Hi, I’m a Brinko.” As each actor labeled herself, she looked back and forth between the other two actors. When not labeling themselves, the actors looked at the speaking actor as she spoke. After all actors had labeled themselves, the actors looked down and paused. Infants viewed this paused scene until the trial ended (see procedure for trial-ending criteria).

In the second familiarization trial, Topid-B and Brinko-B were no longer present. Instead, Topid-A sat centered behind the table. Centered in front of her were two white plates (18 cm in diameter) placed 25 cm apart. The plate on the right held purple pasta and the plate on the left held blue cereal. During the 10-s initial phase of the trial, Topid-A grasped a piece of blue cereal, raised it to her mouth, and ate the food. After eating the food, she proceeded to say, “Mmm!” and smile, displaying positive affect and indicating she enjoyed the food. She then looked down at the center of the table between the two plates and paused until the trial ended. This event was repeated for trials three and four to establish Topid-A’s food preference.

The food Topid-A chose in familiarization trials two through four was counterbalanced across infants. For ease of description, the familiarization and test trials are described from the perspective of infants who saw Topid-A choose blue cereal in the familiarization trials.

**Same-group test trials.** Infants received either a same-food or different-food test trial (see Figure 2). At the start of the trial, none of the actors were present. The plates of

blue cereal and purple pasta again sat on the table. During the 10-s initial phase of the trial, Topid-B walked into view from the left and sat down, centered behind the table. Once seated, Topid-B grasped a piece of blue cereal (same-food event) or purple pasta (different-food event), raised it to her mouth, and ate the food. After eating the food, she proceeded to say, “Mmm!” and smile, displaying positive affect and indicating she enjoyed eating the food. Then, she looked down at the center of the table between the two foods and paused until the trial ended.

***Different-group trials.*** The procedure for the different-group condition was identical to the same-group condition with one exception: the actor who played Topid-B in the same-group condition now played Brinko-B throughout the experiment. In the first familiarization trial, she wore the same costume as Brinko-A and labeled herself as a Brinko. In the test trial, she again wore a Brinko costume, but her actions were otherwise identical to those she performed in the same-group condition.

Infants in both conditions saw the exact same actor in the test trial. All that differed was which costume she wore and whether she had previously labeled herself as a Brinko or a Topid. Thus, any observed differences in looking times across conditions could not be due to a preference for a particular individual.

**Apparatus and procedure.** Infants sat on their parent’s lap 91.5 cm in front of a large television screen (68.5 cm x 122 cm). The room was dimly lit. A camera hidden at the base of the television (centered, 89 cm above the floor) recorded the infant’s face during the experiment. Parents were instructed to close their eyes or look down to avoid biasing their infant’s responses.

The television was connected to a Macintosh computer located to the left of the infant behind a sound-dampening room divider. This computer controlled the presentation of the experimental stimuli using custom software written in Python (Peirce, 2007). The software selected the correct version of each trial based on the infant’s condition and presented the video in the center of the television screen (each video measured 64 cm x 37 cm on screen). The software also controlled the duration of each trial. An experimenter observed the infant on a monitor and pressed a button on the keyboard whenever the infant attended to the video. The software separately computed looking times for the fixed-duration and infant-controlled portions of each trial; looking times during the infant-controlled portion of the trial were used to determine when each trial ended. In between trials, an attention-getter (a yellow smiley face measuring 28 cm x 20 cm) was displayed on the screen for 2 seconds and a brief tone was played to attract the infant’s attention back to the television screen.

At the start of the experiment, the attention-getter was presented in the center of the television screen. When the infant attended to the screen, the experimenter initiated the presentation of the stimuli on the television screen. Infants first viewed the four familiarization trials appropriate for their condition. Each familiarization trial ended when the infant either (1) looked away for 2 consecutive seconds after having looked for at least 4 cumulative seconds or (2) looked for 60 cumulative seconds without looking away for at least 2 consecutive seconds.

Finally, infants viewed a test trial that was appropriate for their condition; half the infants in each condition saw the consistent trial and half saw an inconsistent test trial. This trial ended when infants (1) looked away for .5 consecutive seconds after having



looked for at least 5 cumulative seconds or (2) looked for 30 cumulative seconds without looking away for at least .5 consecutive seconds.

**Coding and analysis.** In order to present events with trial duration contingent on the infant's attention, online coding was conducted by the experimenter (blind to condition and test trial), as described above. All infants were then coded offline from silent video by a trained coder who was naïve to the condition and test trial that the infant received; the looking times resulting from this coding were used in all analyses. For each trial, the coder indicated the infant's direction of gaze (at the stimuli or away) for each frame of the video. Another trained coder who was naïve to the infant's condition and test trial coded 91% of sessions, and these two coders agreed on the child's direction of gaze for 97% of video frames.

Infants were highly attentive during the initial phase of all familiarization trials; averaged across all four familiarization trials, infants attended for 96% of the initial phase. Infants were also highly attentive during the initial phase of the test trial, attending to 99% of the initial phase.

Preliminary analyses of the test data indicated no significant interactions of condition and trial with sex or which food Topid-A preferred in familiarization trials 2-4 (blue vs. purple), all  $F$ s < .618, all  $p$ s > .439. The data were therefore collapsed across these factors in subsequent analyses. In order to control for baseline differences in attention, all analyses were run with average looking time during the final phases of the familiarization trials as a covariate.

## Results

Infants' looking times during the test trial (see Figure 4) were analyzed using an analysis of covariance (ANCOVA) with condition (same-group, different-group) and event (same-food, different-food) as between-subjects factors. There was a main effect of event, indicating that infants looked longer if they saw the different-food event than if they saw the same-food event in the test trial,  $F(1, 31) = 8.56, p = .006$ . The analysis yielded a significant interaction of condition and event,  $F(1, 31) = 11.43, p = .002$ . There was no main effect of condition,  $F < 1$ . Planned comparisons revealed that in the same-group condition, infants who received the different-food event ( $M = 16.1, SD = 5.31$ ) looked reliably longer than those who received the same-food event ( $M = 7.94, SD = 2.29$ ),  $F(1, 31) = 19.23, p < .001$ , Cohen's  $d = 1.99$ . In the different-group condition, infants looked about equally whether they received the same-food event ( $M = 12.82, SD = 2.25$ ) or the different-food event ( $M = 12.53, SD = 5.34$ ),  $F < 1$ .

As predicted, infants in the same-group condition looked reliably longer if they received the different-food event than if they received the same-food event. This suggests that the infants expected members of the same social group to share food preferences, and they looked longer if members of the same social group had different food preferences. In contrast, infants in the different-group condition looked equally regardless of whether members of different social groups picked the same or different foods, which suggests that infants did not expect members of different social groups to share food preferences. Together, the current results provide additional evidence that infants can reason about members of a group that they themselves do not belong to (Powell & Spelke, 2013; Liberman, Woodward, & Kinzler, 2015) and add to these prior findings by demonstrating that infants expect members of social groups to share enduring properties.

### Chapter 3: Experiment 2

The results of Experiment 1 demonstrate that infants expect members of social groups to share preferences. Experiment 2 aimed to investigate the types of information children use to categorize individuals as members of a social group that share common properties. Previous research suggests that noun labels promote kind-based reasoning (Bigler & Liben, 2007; Gelman, 2003) and that in the absence of visual cues, noun labels support social categorization in older children (Baron, Dunham, Banjai, & Carey, 2014). However, for object categories, other types of labels such as adjectives are insufficient at supporting category formation for 4-year-old children (Graham, Booth, & Waxman, 2012). If nouns play a crucial role in supporting categorization, the labeling phrase in Experiment 1 may have been necessary for infants to form social categories. Yet, it is also plausible that it was not the noun label per se, but the act of generally saying the same words and performing a shared activity that supported infants' social group categorization. The act of saying the same words may signal that these individuals engage in similar types of activities and thus share other common properties (Powell & Spelke, 2013; Liberman, Woodward, & Kinzler, 2015). In this case, other words besides nouns would also support categorization.

Here we examined whether the labeling phrase in Experiment 1 was necessary for group induction. The procedure in Experiment 2 was identical to Experiment 1, except for the first familiarization trial. Instead of labeling themselves with nouns, the actors labeled themselves with adjectives<sup>1</sup>. Thus, the actors engaged in a shared activity that did not involve noun labels. If noun labels were necessary for the formation of social categories in Experiment 1, then when the social groups are labeled with adjectives, infants will have no expectation about the preferences of social group members and will look equally regardless of whether members of a social group pick the same foods or different foods. However, if the adjective label is sufficient to form social categories because the actors engage in a shared activity (e.g., Powell & Spelke, 2013), then infants will expect members of the same social category to pick the same foods, and will look longer when they do not.

#### Method

**Participants.** Participants were 14 healthy term infants, 6 male and 8 female (ages 18 months, 3 days to 18 months, 25 days). Data collection is ongoing. The full sample will consist of 18 infants. Another 3 infants were tested but excluded because they became fussy (1), or because of parental interference (2). Half the infants were randomly assigned to the same-food event ( $M=$  19 months, 22 days) and half to the different-food event ( $M=$  19 months, 18 days).

**Apparatus, Stimuli, and Procedure.** The apparatus, stimuli, and procedure were

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<sup>1</sup> An alternative approach to testing the importance of noun labels would have been to remove labels altogether. However, this would have introduced a potential confound. In the absence of language, children may have been less attentive during the first familiarization trial. Any change in test performance could then be due to a lack of attentiveness rather than lack of a label. By using an adjective phrase, the overall amount of language was kept constant and this potential confound was avoided.

identical to the same-group condition in Experiment 1 with the following exception: in the first familiarization trial the actors labeled themselves with adjectives instead of nouns. Topid-A said “Hi, I’m Topish. Topid-B said “Hi, I’m Topish too” and Brinko-A said “Hi, I’m Brinkish” to establish the group memberships.

**Coding and analysis.** As in Experiment 1, all subjects were coded offline by a coder naïve to the test trial the child received. An additional naïve coder coded 93% of the participants. Agreement between the two offline coders was 96%.

Infants were highly attentive during the initial phase of all familiarization trials; averaged across all four trials, infants attended for 99% of the initial phase. Infants were also highly attentive during the initial phase of the test trial, attending to 96% of the initial phase.

Preliminary analyses of the test data indicated no significant interactions of event with sex, or which food Topid-A preferred in familiarization trials 2-4 (blue vs. purple), all  $F_s < .401$ , all  $p_s > .543$ . The data were therefore collapsed across these factors in subsequent analyses.

## Results

To determine whether infants expected members of the same social group to prefer the same foods when the social groups were labeled with adjectives, infants’ looking times during the test trial (see Figure 5) were analyzed using an analysis of covariance (ANCOVA) with event (same-food, different-food) as a between-subjects factor, and infants’ average looking times during the final phases of the familiarization trials as a covariate. Results revealed a main effect of event,  $F(1, 11) = 8.55, p = .014$ . Infants looked longer if they saw the different-food event ( $M = 17.68, SD = 6.69$ ) than if they saw the same-food event ( $M = 10.87, SD = 3.62$ ) in the test trial. Although these results are preliminary, they suggest that similar to the same-group condition in Experiment 1, infants in the adjective condition expected members of a social group to share food preferences, and looked longer when members of the same social group had different preferences. Although data collection is ongoing, we expect that with the full sample this effect will become even more robust.

Next, infants’ looking times in Experiment 2 were compared to each of the conditions in Experiment 1. First, infants’ looking times in the adjective condition of Experiment 2 were compared to the same-group condition of Experiment 1 using an ANCOVA with condition (same-group, adjective) and event (same-food, different-food) as between subject factors, and infants’ average looking times during the final phases of the familiarization trials as a covariate. Results revealed a main effect of event,  $F(1, 27) = 23.80, p < .001$ . There was no main effect of condition and no interaction of condition and event, both  $F_s < 1$ . These results suggest that, regardless of how the social groups were labeled, infants expected members of the same social group to prefer the same foods. Next, infants looking times in Experiment 2 were compared to the different-group condition of Experiment 1. An ANCOVA with condition (different-group, adjective) and event (same-food, different-food) as between subject factors, and infants’ average looking times during the final phases of the familiarization trials as a covariate revealed a significant interaction of condition and event,  $F(1, 27) = 7.20, p = .012$ . There was a trending effect of event  $F(1, 27) = 3.65, p = .067$ , indicating that infants looked longer at the different-food event than at the same-food event. There was no main effect of

condition,  $F(1, 27) = .017$ ,  $p = .897$ . The fact that looking times to the two events differed across conditions suggests that the infants in the adjective condition did not merely look longer when a new food was chosen. Instead, infants looked longer in the different-food event because they expected members of the same social group to share preferences. Thus, both noun and adjective labels were sufficient for infants to form stereotyped beliefs about these arbitrary social groups. This suggests that it may not be the noun-label per se, but the act of performing similar actions and generally saying the same words that encouraged the formation of stereotyped beliefs.

## Chapter 4: General Discussion

By preschool age, children expect members of a social group to share characteristics. The current studies examined the origins of this stereotype-based reasoning in infancy. Specifically, we examined whether infants expect members of a social group to share preferences and the types of information children use to categorize individuals as members of a social group that share common properties. Infants were introduced to members of two arbitrary social groups, Topids and Brinkos, and learned that a particular Topid preferred purple pasta. Infants later expected another Topid to prefer the same food, and were surprised if she did not. Infants held similar expectations if the group members labeled themselves with adjectives (i.e. Topish and Brinkish) rather than nouns. However, infants did not expect members of different social groups (i.e. a Topid and a Brinko) to share preferences. Together, these findings provide the first empirical evidence that infants as young as 20 months form stereotyped beliefs about arbitrary social groups. The fact that infants expected members of the same, but not different, social group to share food preferences demonstrates that infants did not merely generalize preferences regardless of social group membership; instead, infants made inferences about the stable, inherent characteristics of the social groups.

One possible limitation of the current study is that infants may have thought the actor in the test trial was the person that they saw choose a food in the familiarization trials. Although possible, this is unlikely for several reasons. The actors in both experiments looked dissimilar on multiple features (i.e., different hair colors, hair styles, etc.) to make it easier for infants to discriminate between them. Further, prior research suggests that 6-week-old infants are good at discriminating faces. When 6-week-old infants were exposed to a face for 2 minutes, the infants were able to differentiate between the face they had seen previously and a new face 2 weeks later (Fagan, 1973). If 6-week-old infants remember faces after 2 weeks based on a brief observation, it is highly likely that the 20-month-old infants in the current experiment could remember faces a few seconds later. Nevertheless, we are exploring this possibility in ongoing research.

These findings expand our understanding of infants' social-group reasoning and stereotype-formation in several ways. First, these studies provide additional evidence that infants can reason about groups they are not members of (Powell & Spelke, 2013; Liberman, Woodward, & Kinzler, 2015). Second, these studies expand on these previous studies in a key way by showing that infants reason about groups even when other group members are not present. Because only one agent was present in the test trial, infants' expectations about the behaviors of group members could not have been influenced by social pressures. Further, the Topid in the test trial did not see which food the Topid in the familiarization trials selected, preventing infants' expectations from being influenced by imitation. Even without the presence of other group members, infants expected members of a social group to share stable, enduring properties.

Third, these experiments begin to shed light on the factors that support group induction. In the current study, infants expected members of the same social group to share preferences when either labeled with a noun or an adjective. However, this is somewhat different than what was found with older children. Graham et al. (2012) found that 4-year-old children who heard an object labeled with an adjective did not later infer

that objects of the same kind would behave similarly. When people were labeled with an adjective in the current study, children did infer that these people would have similar properties in the future. There are several possibilities that could explain why the current studies obtained different results than Graham, Booth, and Waxman (2012). One possibility is that the older children may treat adjective and noun labels differently than younger infants. Compared to older children, infants may have a less clear understanding of what adjectives signify, causing infants to treat adjectives as similar to nouns. Another possibility is that children may treat adjectives differently when they are applied to social groups. Thus, infants may draw different inferences about different kinds of categories, even when given the same adjective. A third possibility is that infants may not be treating adjectives differently than nouns, but that other factors such as engaging in shared actions or saying the same words may be sufficient for infants to form social categories. That is, it could be that like older children, infants expect nouns, but not adjectives, to imply similarities, but because the actors engaged in a shared activity in the current study, it may have overridden the influence of the adjectives and caused infants to expect group members to be similar. This element of shared action did not occur in Graham et al. (2012) because objects are unable to engage in shared activity. Instead, a third party provided the adjectives that described the objects. Perhaps if a third party described the social groups with adjectives in the current experiment, similar results to Graham and colleagues (2012) would be obtained. Lastly, it may be that children did not need either an adjective or a noun or even a shared activity, but that the matching costumes alone were sufficient for infants to form the social groups. Although this is a possibility, prior research makes it unlikely that infants only attended to the costumes. For example, prior research with 4-year-old children suggests that visual cues alone are not enough for children to form social groups (Baron, Dunham, Banaji, & Carey, 2014). If visual cues are not sufficient for older children to form social categories, they may also be insufficient for infants to form social groups. However, in order to address the impact of matching costumes alone, care would need to be taken to ensure that children found the initial familiarization trial equally as interesting when devoid of language. Additional research on infants' perception of these groups without salient costumes or engaging in a shared activity is needed.

The current studies suggest that by 20 months of age, infants spontaneously categorize individuals as members of a social group and form inferences about the stable, inherent characteristics of the group's members. But how does this tendency to form stereotyped beliefs about social categories emerge in infancy? One possibility is that from birth, infants assume that members of a social group share commonalities. Of course, specific stereotypes must be learned because they vary across cultures (Birnbaum, Deeb, Segal, Ben-Eliyahu, & Diesendruck, 2010), but it is possible that this tendency to form social groups and expect the group's members to behave similarly is present at birth. An alternative possibility is that not only do stereotypes have to be learned, but the tendency to treat people as similar also has to be learned. Perhaps, hearing talk that highlights commonalities amongst members of a group teaches infants that group members are similar. Parental use of generic statements may be one type of parental talk that influences infants' inferences about stereotypes. Research suggests that hearing generic statements fosters essentialist reasoning in adults and preschoolers, encouraging them to

view social group members as sharing an inherent nature (Rhodes, Leslie, & Tworek, 2012). By 2 years of age, infants hear generic statements produced by their parents (Gelman, Goetz, Sarnecka, & Flukes, 2008). One possibility is that infants who hear more generic statements may be more likely to exhibit stereotyped beliefs. Hearing generic statements may cause children to develop essentialist views, inferring that members of a category share a deep, inherent nature. Another possibility is that hearing general statements causes children to develop specific stereotypes about the groups that were generalized. To date, no one has looked at parents' tendency to use generics prior to age 2 (Gelman, Kleinberg, Ware, Manczak, & Stilwell, 2014; Rhodes, Leslie, & Tworek, 2012, Gelman, Chesnick, & Waxman, 2005). Whether this input actually affects infants' reasoning about social groups needs to be examined in future research.

In the current study, we examined preferences because foods are culturally relevant and thus likely to be shared amongst members of a social group (Cashdan, 1998; Rozin & Siegal, 2003). But what other kinds of inferences and stereotypes do children make? In the current study, infants generalized preferences across members of a social group. Prior research suggests older children and adults may also expect social groups to share other characteristics such as preferences for activities, personality traits, and adherence to social norms. For example, 5-year-old children and adults expect that members of the same social category will prefer the same activities (Diesendruck & haLevi, 2006). Children and adults were told about a target character that was religious and liked to play "Zaber". When presented with another exemplar from the same social group (a religious boy) and an exemplar from a different social group (a secular boy), children expected another religious character to also like playing "Zaber", but expected a secular character to like a different activity (Diesendruck & haLevi, 2006). Further, preschool-aged children expect that members of the same, but not opposite sex will prefer the same toys (Martin, Eisenbud, & Rose, 1995). For adults, personality traits (i.e. whether someone is nice, mean or lazy) are commonly stereotyped (e.g., Bian, 2014; Diesendruck, & HaLevi, 2006; Gonzalez, Zosuls, & Ruble, 2010; Heyman & Gelman, 1998). Research on children's intergroup attitudes suggests that children may also expect members of the same social group to share personality traits. When elementary school children were assigned to either a "blue" or "yellow" group in their classroom, children inferred that members of their own group would have more positive traits (e.g. friendly, good, nice, smart) than members of the outgroup (Bigler, Jones, & Lobliner, 1997; Bigler, Brown, & Markell, 2001). Additionally, preschool-aged children expect that members of the same social category will be subject to the same social norms. When told that a member of a social category, a "Lissan", chose to eat vanilla ice cream because she is not allowed to eat chocolate, children expected that another Lissan would also choose vanilla because they were not allowed to eat chocolate (Kalish, 2012). If older children expect members of a social group to share activity preferences, social norms, and personality traits, the tendency to generalize these characteristics across social groups may also be present in infancy. Future research should examine these possibilities.

The results from the current study provide the first empirical evidence that infants as young as 20 months demonstrate stereotype-based reasoning about groups that they themselves are not a part of. Together, these studies begin to shed light on the circumstances for which infants treat social group members as alike, and the age at which

these stereotyped expectations emerge. Future research should continue to explore the necessary features for infants to form social categories, as well as additional characteristics that infants form stereotyped-beliefs about such as preferences for activities, preferences for objects, and personality traits.



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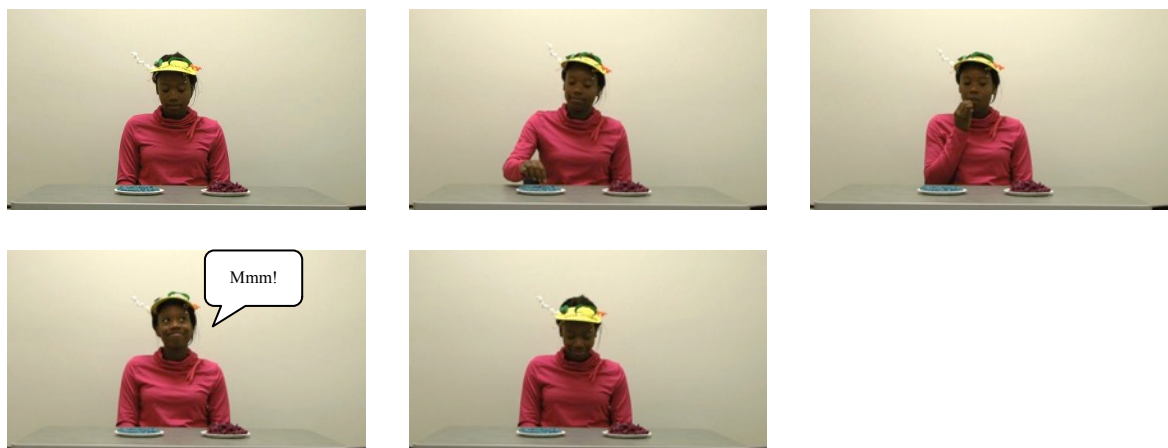
## Appendix

### Same-Group Condition

#### Familiarization Trial 1



#### Familiarization Trials 2-4

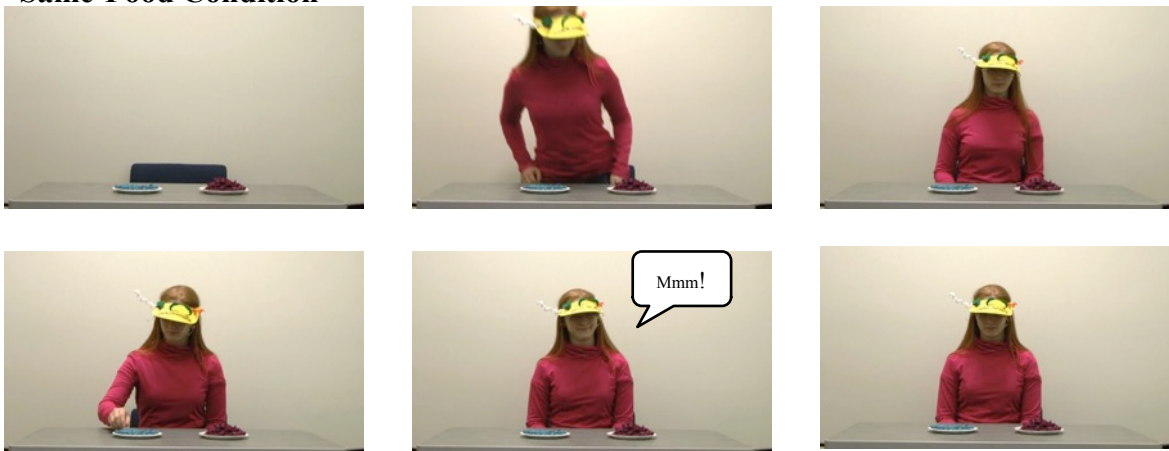


**Figure 1.** Events shown in the familiarization trials 1-4 of the same-group condition of Experiment 1. Infants viewed three repetitions of trial 2. Which food Topid-A selected was counterbalanced across infants.

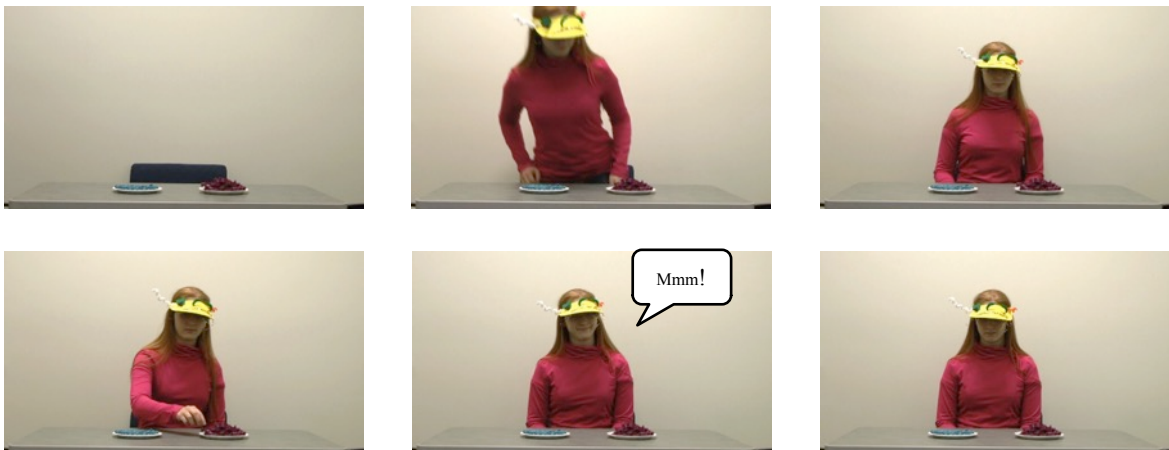
## Same-Group Condition

### Test Trials

#### Same-Food Condition



#### Different-Food Condition



**Figure 2.** Events shown in the test trials of the same-group condition in Experiment 1. Infants saw either the same-food event, or the different-food event.

## Different-Group Condition

### Familiarization Trial 1



### Test Trials

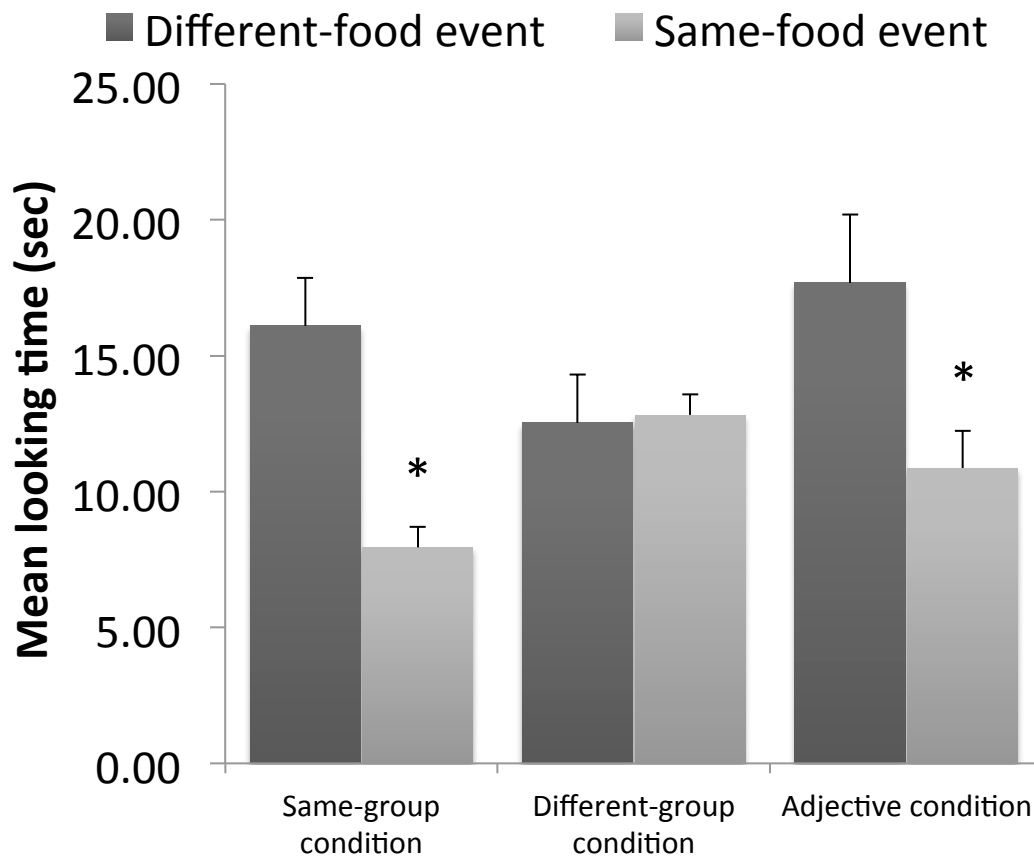
#### Same-Food



#### Different-Food



**Figure 3.** Schematic depiction of the key differences between the same-group and different-group conditions in Experiment 1. In familiarization trials 2-4, infants in the different-group condition saw the same events as those in the same-group condition. Then, infants saw either a same- or different-food test trial that was identical to the same-group condition except for the costume worn by the agent.



**Figure 4.** Results from Experiment 1 and 2. Mean looking time (s) of the infants during the test trial as a function of condition and event. Error bars represent standard errors, and an asterisk denotes a significant difference between the trials within a condition ( $p < .05$ )