Who Can Be in a Group? 3- to 5-Year-Old Children Construe Realistic Social Groups

Through Mutual Intentionality

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Abstract

Recent research suggests that young children's causal justification for minimal group membership can be induced via a cognitive framework of mutual intentionality. That is, an individual can become a group member when both the individual and group agree to membership. Here, we investigated if children ages 3-5 understand groups formed by mutual intentions and whether they apply mutual intentions to realistic groups with varying entitative and essentialized qualities. In two studies ($N = 197$), we asked 3-, 4-, and 5-year-old children if a novel character could join an existing group based on intentionality (mutual, individual-, group-only) and group type (task, friends, family). We find that 4- and 5-year-olds robustly relied on mutual intentions to constitute group membership and 3-year-olds also demonstrated emerging usage of this cognitive framework. Moreover, children employed mutual intentionality across different group types, suggesting a general framework for children's understanding of different social groups.

Keywords: groups; group entitativity; cognitive development; mutual intentionality; group essentialism

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Children must learn to navigate a socially complex world that consists not only of individuals, but also social groups that are defined in myriad ways (e.g., Kelly et al., 2005). These social groups are significant because they influence children's perception of the social world and shape both attitudes and behaviors. For example, ingroup versus outgroup distinctions predict a host of responses including ingroup bias (Aboud, 2003; Brewer, 1999), implicit bias (Devine, 1989; Dunham et al., 2013), and moral obligations (Rhodes, 2012; Shutts et al., 2013). However, before children can reliably make distinctions between ingroups and outgroups, they must learn to decipher what unspoken rules might determine group membership. Here, we explore how children determine group membership across different types of realistic social groups through a specific cognitive perspective.

Broadly, children can begin to make sense of human behavior and social relationships by relying on different intuitive theories, unique expectations and causal beliefs that provide a structure for understanding their social world (Gelman & Lagare, 2011; Gerstenberg & Tenenbaum, 2017; Wellman & Gelman, 1998). One specific theory children may employ when approaching social groups is the expectation that these groups connote unique social-relational information, meaning children may expect coalitional relationships between members of some group types (Hirschfeld, 1996; Rhodes, 2012). For example, children readily expect that even members of novel and socially-inconsequential (i.e., minimal) groups have certain relational obligations to one another (e.g., Kalish & Lawson, 2008; Rhodes & Chalik, 2013). Further, when determining who is or is not a member of a minimal group, children often also rely on the observed mutual intentions, or shared desires about group membership, between an individual

and the group to constitute group joining (Noyes & Dunham, 2017). Yet, limited research has explored this social-relational perspective which children often apply to groups (but see Noyes & Dunham, 2017; Rhodes & Brickman, 2011 as examples). Thus, the aim of the present research is to explore how broadly and developmentally early children may rely on mutual intentionality as a causal framework that constitutes group membership. Specifically, we consider how different types of groups that vary in their levels of perceived essentialism and entitativity (terms we define in the next section) may impact children's use of a mutual intentionality perspective.

Group Properties: Essentialism and Entitativity

Some social groups are believed to be marked by an underlying and stable “essence” that dictates one's membership in that group (Diesendruck & HaLevi, 2006; Gelman, 2003; Gelman, 2004; Hirschfeld, 1996; Rhodes & Mandalaywala, 2017). Certain social groups are high in perceived essentialism such that their category-defining features are considered highly stable and immutable (e.g., gender; Rhodes & Mandalaywala, 2017) while other groups are seen as more flexible, being linked by societally inconsequential factors (e.g., same t-shirt colors or other minimal groups; Rhodes et al., 2012; Rhodes & Brickman, 2011). Indeed, essentialized qualities are perceived to be varied across social group category types (e.g., gender, political ideology, race/ethnicity). For example, adults tend to essentialize race viewing members of different racial groups as having immutable, discrete, and necessary features (e.g., skin color; Haslam et al., 2000; Prentice & Miller, 2007). Similarly, children also show strong essentialist beliefs about some groups like gender (see Rhodes & Mandalaywala, 2017 for review). Although essentialist beliefs are often inaccurate compared to scientifically-based realities, these lay theories are powerfully inductive and predict a host of socially harmful, cognitively-based outcomes for both

adults and children that influence one's behavior (e.g., stereotype endorsement; Bastian & Haslam, 2006; Pauker et al., 2010).

As people hold beliefs about the essentialized properties of groups, they similarly hold beliefs regarding group entitativity.¹ A group's entitativity refers to its quality of perceived "groupedness" such that a collection of people is either seen as a "real group" or not. For example, children consider "friends" to have entitativity, making them a "real group," compared to people waiting at a bus stop (Plötner et al., 2016). Similar to the variability of perceived essentialism, adults and even 10-year-old children perceive differing levels of entitativity between group types (Lickel et al., 2001; Svirydzenka et al., 2010) although younger children may not make as fine-grained distinctions (Plötner et al., 2016). Moreover, groups that are seen as highly entitative by adults are also perceived to have high uniformity among group members (Haslam et al., 2000), such that a group's entitativity may be related to perceived similarity as well as shared traits and goals (Campbell, 1958). Taken together, beliefs about the essentialized and entitative qualities of groups may influence how children cognitively perceive and process their social world, and yet there remains limited empirical assessment of children's understanding of entitative group properties.

Work by Plötner et al. (2016) found that children as young as 5-years-old can distinguish entitativity between four group types (intimacy, task, social categories, and loose associated; e.g., Lickel et al. 2001) in a similar pattern to adults and 10-year-olds (Svirydzenka et al., 2010). Yet in contrast to adults, children's perceptions of entitativity may be particularly influenced by the level of interaction between group members (Svirydzenka et al., 2010). Similarly, a study by

¹ Some scholars agree that entitativity is a component of essentialism beliefs (e.g., Haslam et al., 2000, 2002) while others have argued that entitativity should be considered a distinct concept (e.g., Andreychik & Gill, 2014; Hamilton, 2007). Here, we recognize that social groups may be regarded by both their essentialized and entitativized properties.

Sheikh & Hirschfield et al. (2019) found that preschool-aged children (4.5- to 6.1-years-old) and adults were more likely to conceptualize a minimal group as being entity-like when that group was seen as having shared goals. Thus, both entitativity and mutual intentionality relate to shared intentions and goals between people (e.g., Campbell, 1958; Noyes & Dunham, 2017). Given this conceptual similarity, a group's perceived entitativity might preferentially influence children's application of a mutual intentionality framework. That is, if a group is perceived as highly entitative, such that its members are believed to have existing shared intentions, children then may readily view group joining through a mutual intentions perspective.

Yet, research to date on children's cognitions about group categorization has largely focused on the perceived essentialism of groups (see Rhodes, 2020 for review). To our knowledge, no work has experimentally explored how both the essentialized and entitativized qualities of a group may impact the inductive potential of group categorization. Noyes and Dunham (2017) previously investigated children's understandings of groups and considered mutual intentionality as causal to group membership for non-essentialized groups (novel minimal groups), but not highly-essentialized groups (gender) with children ages 4- to 9-years-old. Here, we expand on this work by testing whether children also apply mutual intentionality to determining group membership among realistic social groups. Further, because children begin demonstrating essentialized beliefs about certain groups as young as 3-years old (e.g., gender; Heyman & Giles, 2006), we also sought to investigate children's understanding of group formation via mutual intentions at this young age. Including 3-year-olds allows for a broader understanding of children's social cognitive development, while also testing how a mutual intentionality framework may fluctuate towards groups with differing essentialized and entitativized qualities.

Group Types

First, we consider the types of realistic groups (i.e., non-minimal groups as commonly studied in the literature) people encounter and how these different groups are perceived. Adults and children perceive four main group types: loose associations (e.g., standing in line), social categories (e.g., gender), task groups (e.g., coworkers), and intimacy groups (e.g., family or friends; Lickel et al., 2000; 2001; Svirydzenka et al., 2010). As young as 5-years-old, children consider social categories, task groups, and intimacy groups to be “real groups” (Plötner et al., 2016), having similar levels of entitativity. Moreover, some of these entitativized groups also have essentialized qualities. For instance, family as one type of entitativized intimacy group can often be described by members’ biological relatedness (e.g., Keller, 2005), and genetic inheritance is often considered an integral part of essentialist beliefs (e.g., Hirschfeld, 1995). However, another entitativized intimacy group like friends consists of members that are not linked by an intrinsic “essence” and group boundaries are non-discrete and permeable. Between these differing entitative and essentialist qualities, it is unclear what specific intuitive social theories may be applied to intimacy groups. Here, we use friend and family groups to test children’s social-relational approach of making causal decisions about group membership. We begin by discussing the unique qualities of these intimacy groups.

Intimacy group: friends. Past research demonstrates that young children perceive group members to possess group-specific qualities (youngest age tested is age 5; Plötner et al., 2016). For example, children believe that members in a friend group (e.g., intimacy group), rather than a task group, are more likely to share with, like, and have loyalty towards other intimacy group members. However, these specific expectations of intimacy groups may develop even earlier as children as young as 3.5 years expect both friends and family members to preferentially share

with one another over strangers (Olson & Spelke, 2008). Further by age 3, children begin to form reciprocal relationships as they are able to engage in triadic interactions with others (Ishikawa, 2003) and partner-play comes online (Hay et al., 2004). Children also demonstrate some early conceptualizations of the word “friend,” typically referring to a shared activity partner (Corsaro, 1988). And although children’s understanding of friendship may not yet involve beliefs about longevity or stability, children do appear to cognitively recognize other children who are friends and judge social transgressions based on their “friend” status (Slomkowski & Killen, 1992). Thus, it is possible that children may be applying naïve group categorization theories to friend groups at earlier ages than previously tested.

Intimacy groups: family. Family is a highly salient group for young children– in line with Bronfenbrenner’s (1979) ecological model, a child’s family often serves as their first social connections and young children tend to recognize family members by relationship quality including mutual love and support (Bhopal et al., 2000; Morrow, 1998; Smart et al., 2001). Although “family” is considered a highly entitative group, “family” is unique from other highly entitativized groups like “friends.” For example, research suggests that entitativity may be influenced by the autonomy of individual group members such that people perceive those in “chosen” categories (e.g., occupation) as more entitative than a “forced” category (e.g., race; Demoulin et al., 2006). Unlike friend groups, a family group is comprised of individuals of both “chosen” (e.g., spouses) and “forced” connections (e.g., biological siblings). Although this might suggest that “family” would be less entitativized than “friends,” the high proximity (e.g., shared locality and living space), commonality (e.g., shared language, religion, and other cultural practices or traditions), and implicit commitments (e.g., parental care and responsibility)

constructed within families may make family groups highly similar, more stable, and perceived to have long-lasting relations, often more so than other intimacy groups like friendships.

Moreover, unlike other intimacy groups like friends, “family” often implies a biological relationship between group members. Indeed, adults implicitly encode kinship as an essentialized social category similar to sex (Lieberman et al., 2008) and young children also demonstrate some knowledge of a biological basis of kinship (Springer, 1996). This biological quality may imbue perceptions of “family” as having unique essentialist properties, similar to social groups like race and gender that are seen as unalterable, impermeable, and long-lasting. And although certain familial relationships exist without biological ties (e.g., spouses, step-parents and -siblings, fostering and adoption), boundaries of a family group are strict such that non-biological relationships often require legal precedence (e.g., marriage) to gain formal recognition. Similarly, as there is a high barrier to entry, there is also a high barrier to terminate family group membership (e.g., divorce, emancipation), demonstrating the inflexibility of family group boundaries.

The Current Studies

Regarding a mutual intentionality framework, Noyes & Dunham (2017) suggest that mutual intentionality may be applied to only non-essentialized groups as these groups are perceived through a distinct social-relational perspective rather than a separate essentialist perspective. As suggested above, “family,” although not previously tested as a highly-essentialized group, may have essentialized qualities making it uniquely immutable and exclusive. Thus, in line with previous research (Noyes & Dunham, 2017), children may be less apt to apply a mutual intentionality framework towards a family group than other group types. Yet, varying levels of group entitativity may also affect the causal framework children employ to

determining group membership as entitativity confers specific expectations for group members (e.g., loyalty and sharing), and may preferentially be linked to a mutual intentionality framework. Together, these entitative and essentialized qualities of certain groups may confound children's reliance on a social-relational perspective of group membership.

Here, we aim to explore whether a mutual intentionality framework may be used to make causal justifications about group joining for realistic social groups with varying entitative and essentialized properties. To investigate the application of mutual intentionality, we use a group joining paradigm (adapted from Noyes & Dunham, 2017) testing whether children believe a novel individual can join an existing group or not. Here, we test 3-, 4-, and 5-year-olds for the first time within this paradigm to measure developmentally when a mutual intentionality framework may be cognitively online and how it may be applied to different group types. Specifically, we compare three groups with highly entitativized qualities (e.g., Lickel et al., 2001, 2001) and decreasing essentialized qualities: family, friends, and task groups respectively.

We expect that children will respond differently to novel group joining based on three factors: 1) the child's age, 2) mutual or non-mutual (i.e., single-sided) intentionality of the non-member individual and the existing group, and 3) the type of group (task, friend, family). Specifically, we hypothesize (H_1) that older children (5-year-olds) will more readily apply a mutual intentionality framework compared to younger children (3-year-olds), (H_2) who will instead show more flexibility in their allowances for group joining. We also predict that across entitativized groups, (H_3) an intimacy group with essentialized qualities (family) will be harder to join than groups with looser relational associations (task group). Study 1 is the initial test of these questions and Study 2 serves as a replication and more conservative test of a revised family stimuli where we also ask children to express their reasoning.

Methods – Study 1

Participants

An *a priori* power analysis in G*Power 3.1 (Faul et al., 2009) indicated that 96 participants would be sufficient to observe a significant ($\alpha = 0.05$) repeated measures, within-between ANOVA model with 95% power and a small effect size ($\eta_p^2 = .02$) due to testing for high-order interactions. We assumed moderate correlation among repeated measures ($r = .30$) and no correction for non-sphericity. Our pre-registration plans and data are available here: [OSF for peer review](#). Participants were recruited in the southeastern U.S. from Spring 2018 to Fall 2019 at local science museums, community events, and through a departmental database. Families were compensated with \$10 if participating in-lab or with a small prize if participating remotely following organization payment preferences. All methods were approved by the university's institutional review board.

In total, 101 participants, ages 3- to 5-years-old were recruited for the study. Following the pre-registration, data were excluded from analysis if (i) the participant was unable to respond to a minimum of half of the trials (e.g., fewer than 5 out of 9 trials; $n = 1$), and/or if (ii) the experimenter notes flagged a participant as highly distracted or disengaged during the study (e.g., “very distracted/could not pay attention,” “child wasn’t verbal, didn’t seem to understand what was going on” $n = 2$). Of the included data ($N = 98$ after initial exclusions), 5 participants ($n_{3\text{-year-old}} = 1$; $n_{5\text{-year-old}} = 4$) each skipped 1-out-of-9 trials or 0.57% of all study trials. Trials skipped were: (i) $n = 1$ Task Group x Group-only Intentionality, (ii) $n = 1$ Friend Group x Mutual Intentionality, (iii) $n = 1$ Family Group x Group-only Intentionality, (iv) $n = 2$ Family Group x Mutual Intentionality. As the final analytic model could not analyze participant’s with partial data, the final analyzed sample size was 93 participants.

Our final analyzed sample included 93 children consisting of 41 boys, 52 girls, and 0 non-binary or other gendered children. Additionally, the sample is 75.3% White, 8.6% Multiracial/ethnic, 7.5% Black or African American, 6.5% Asian or Asian American, 2.2% other race/ethnicity. Across the ages of 3- to 5-years-old, the group totals and means are as follows: 3-year-olds, $n = 31$, $M_{\text{age}} = 3:7$ (3 years and 7 months), $SD = 0.3$, range = 3.16–3.99; 4-years-old, $n = 36$, $M_{\text{age}} = 4:6$, $SD = 0.3$, range = 4.05–4.97; and 5-years-old, $n = 26$, $M_{\text{age}} = 5:4$, $SD = 0.3$, range = 5.00–5.84².

Stimuli

Cartoon images were adapted from previous work (Rhodes & Brickman, 2011; Rhodes & Chalik, 2013; Noyes & Dunham, 2017) to depict three distinct social groups varying in entitativity (Plötner et al., 2016): (i) a “task group” with ties only through a non-socially related task (i.e., children building blocks), (ii) an “intimacy group” with social ties (i.e., friends eating lunch together), and (iii) an “intimacy group” with social and biological ties (i.e., family). Each group consisted of three children with different combinations of hair and clothing (see Figure 1).

Nine additional individual characters (adapted from the same stimuli) were created to be paired with one of three intention conditions: (i) individual-only, the novel individual wants to join the group but the existing group does not want the individual to join, (ii) group-only, the existing group wants the novel individual to join but the individual does not want to join, and (iii) mutual, both the individual wants to join and the group wants the novel character to join as well. These unique characters were assigned different names and were edited with different hair

²Age ranges based on date of birth (DOB) reporting from 78.6% of subjects’ parent/guardian (data missing due to parent/guardian nondisclosure of DOB or ID matching error). Parent/guardian reported annual income: 18.4% did not complete the optional demographic form, 7.1% under \$25,000, 4.1% \$25,001–\$50,000, 20.4% \$50,000–\$75,000, 23.5% \$75,001–\$125,000, 26.5% over \$125,001. Parent/guardian reported educational attainment (mean percentages of Caregiver 1&2): $M = 17.4\%$ did not complete the optional demographic form, $M = 2.6\%$ elementary school, $M = 4.1\%$ High school or equivalent, $M = 9.7\%$ community college/vocational school, $M = 21.9\%$ 4-year college/university degree, $M = 44.4\%$ professional/graduate school.

and clothing (see Figure 2). Following past research, all characters were depicted as white and male to control for cross-race or cross-gender group joining confounds. However, as children prefer same-sex play-partners (Maccoby, 1990), one “member” of the family group was depicted as female to represent a difference between friendship and kinship groups.

Design and Procedure

The experiment took place in a quiet location at the respective testing site using Qualtrics on an iPad. Each participant was presented with all nine conditions in a randomized order. In total, participants saw the three group types (task, friends, family) paired with three different intentionality types (individual-only, group-only, mutual). The script used to signal the different intentionality types was adapted from Noyes & Dunham (2017). In each session following this within-subjects design, one of three groups was first randomly presented to the participant on the iPad screen and the experimenter would verbally label the group (e.g., friend group: *“Look! These kids here are friends. They’re all eating lunch together”*). Next, participants were introduced to a novel individual character paired with an intentionality type. Intentionality types and character pairings were randomized across trials. The experimenter acknowledged the new character and stated the intentionality of both the group and the individual (e.g., Group-only intentionality: *“Look! This is Paul. The lunch friends want Paul to be in the lunch friends. Paul tells the lunch friends he cannot be in the lunch friends”*). Next, participants were asked *“Is [Solo Character Name] in the [Group Name] or not in the [Group Name]?”* and their verbal response (“yes” or “no”) was recorded. If participants did not respond with “yes” or “no” (i.e., no response or “I don’t know”) the experimenter restated the question with the additional phrase *“Do you think yes or no?”* If the participant did not respond a second time, the experiment left the response blank and continued to the next randomized set. Because young children show

variation in their understanding of friendship such that young preschoolers may not yet understand the longevity of a friendship versus other relationships (e.g., Corsaro, 1988), additional information such as group longevity was not included (e.g., “The friends always eat lunch together”). This also kept the instructions brief which was important as this study targets a younger age group than previous research.

This procedure continued until all characters, group types, and intentions were presented. In sum, our procedure included nine conditions in a 3x3 within-subject design: three group types (task, friends, family) presented in a random order with each of the three intention types (mutual, individual-only, group-only). Each participant saw all nine conditions such that there were nine measurements per participant.

Figure 1

Study 1 Group Stimuli

Note. Stimuli examples from left to right: task group (block builders), intimacy group (friends), intimacy group (family)

Figure 2

Study 1 and Study 2 Individual Stimuli

Note. Examples of individual characters paired with different group types as a function of intentionality conditions.

Results – Study 1

Analytic Strategy

Study 1 followed a within-subject design with a binary outcome variable (0: not join, 1: join). To test for the effects of group type (within-subjects: task group, friend group, family group), intentionality (within-subjects: individual-only, group-only, mutual), and child age (between-subjects: 3-, 4-, 5-years-old) on joining, we used a repeated measures ANOVA model. Recent research recommends the use of linear models (even when dealing with binary outcomes) because the output offers more interpretable results, particularly when testing for 2- and 3-way interactions among categorical predictors (Gomila, 2020). Thus, our results are in the form of means between 0 and 1 that represent the joining “rate” per group. Further, the use of a repeated measures ANOVA allowed us to compare rates of joining across and within each age group (3, 4, 5), intentionality (individual, group, mutual), and group type (task, friend, family).³ This analysis revealed one significant main effect, two significant interactions, and two marginally significant interactions, described below (see Table 1 for full model).⁴

Main Effect of Intentionality and Interaction of Intentionality by Age

³ Please refer to the [OSF Transparent Changes](#) document for justification and reasoning for pre-registration deviations.

⁴ Additionally, to better understand children’s use of mutual intentionality, we conducted an exploratory analysis comparing children’s use of each intentionality type across groups to chance. Please refer to the Supplemental Materials to view this additional analysis.

The repeated measures ANOVA revealed a significant main effect of intentionality, $F(2, 180) = 73.99, p < .001, \eta_p^2 = 0.45$, and this effect was qualified by a significant interaction between intentionality and age, $F(4, 180) = 6.34, p = .001, \eta_p^2 = 0.12$. Simple effects analysis (Bonferroni correction) revealed that both 4- and 5-year-olds were more likely to permit joining when mutual intentions were used than when single-sided intentions were used (see Table 2 for means), $p < .001$. 3-year-olds also allowed significantly more joining with mutual intentionality over individual-only intentionality, $p = .010$. Furthermore, joining allowance under mutual intentionality, but not single-sided intention types ($p > .998$), marginally increased between 3- to 4-years old, $p = .065$, and significantly between 3- to 5-years old, $p = .001$ (Figure 3).

Interaction of Group Types by Age

Study 1 also revealed an interaction between group type and age, $F(4, 180) = 2.70, p = .036, \eta_p^2 = .06$. Simple effects analysis (Bonferroni correction) revealed that for 3-year old children, there was no difference in joining rates permitted across the three group types ($p > .759$). 4-year-olds allowed joining at the same rates for task groups and friend groups, but allowed marginally less joining for the family group compared to friends, $p = .061$. However, this pattern inversed at 5-years-old. Here, children did not distinguish between task and family groups, yet allowed significantly less joining for friend groups than family groups ($p = .020$; see Figure 3).

Marginal Interaction of Intentionality and Group Type

Finally Study 1 showed a marginally significant interaction between group type and intentionality, $F(4, 360) = 2.10, p = .088, \eta_p^2 = .02$, and a marginal interaction between all three predictors (age, group type, and intent), $F(8, 360) = 1.88, p = .065, \eta_p^2 = .04$. Simple effects (Bonferroni correction) of the marginal interaction between intentionality and age suggests that

children allowed more joining for all three group types when mutual intentionality was used versus non-mutual intentionality (individual- or group-only, $ps < .001$).

Table 1*Study 1 Repeated measures ANOVA Results*

Predictor		<i>df</i> 1	<i>df</i> 2	<i>F</i>	<i>p</i>	η_p^2
Age	Between Subjects	2	90	1.04	.356	0.02
Group Type	Sphericity Assumed	2	180	2.09	.127	0.02
	Greenhouse-Geisser	1.87	168.27	2.09	.130	0.02
Intent***	Sphericity Assumed	2	180	73.99	<.001	0.45
	Greenhouse-Geisser	1.42	127.67	73.99	<.001	0.45
Group Type by Age*	Sphericity Assumed	4	180	2.70	.032	0.06
	Greenhouse-Geisser	3.74	168.27	2.70	.036	0.06
Group Type by Intent	Sphericity Assumed	4	360	2.05	.088	0.02
	Greenhouse-Geisser	3.83	344.89	2.05	.090	0.02
Intent by Age***	Sphericity Assumed	4	180	6.34	<.001	0.12
	Greenhouse-Geisser	2.84	127.67	6.34	.001	0.12
Group Type by Intent by Age	Sphericity Assumed	8	360	1.88	.065	0.04
	Greenhouse-Geisser	7.66	344.89	1.88	.061	0.04

Note. * $p < .05$, ** $p < .01$, *** $p < .001$; Mauchly's Test of Sphericity indicated that the assumption of sphericity was violated for the predictor of Intentionality, $\chi^2(2) = 46.95$, $p < .001$, and Group Type, $\chi^2(2) = 6.43$, $p = .040$, but not the interaction of Intentionality and Group, $\chi^2(9) = 7.64$, $p = .571$. Therefore, the Greenhouse-Geisser correction was used across specific tests (terms in bold are those interpreted).

Table 2*Study 1 Means (M) and Standard Deviations (SD) of Joining Rates by Age, Intention, Group*

	Intentionality	Task Group	Friend Group	Family Group	MM (SE)	
		M (SD)	M (SD)	M (SD)		
3-years-old	Individual-only	0.16 (0.37)	0.23 (0.43)	0.10 (0.30)	0.16	(0.06)
	Group-only	0.19 (0.40)	0.23 (0.43)	0.29 (0.46)	0.24	(0.06)
	Mutual	0.52 (0.51)	0.32 (0.48)	0.35 (0.49)	0.40	(0.07)
	MM (SE)	0.29 (0.05)	0.29 (0.06)	0.25 (0.05)		
4-years-old	Individual-only	0.19 (0.40)	0.14 (0.35)	0.14 (0.35)	0.16	(0.05)
	Group-only	0.22 (0.42)	0.27 (0.45)	0.14 (0.35)	0.21	(0.06)
	Mutual	0.62 (0.49)	0.65 (0.48)	0.57 (0.50)	0.63	(0.07)
	MM (SE)	0.35 (0.05)	0.36 (0.05)	0.29 (0.05)		
5-years-old	Individual-only	0.12 (0.33)	0.15 (0.37)	0.15 (0.37)	0.14	(0.06)
	Group-only	0.19 (0.40)	0.08 (0.27)	0.19 (0.40)	0.15	(0.06)
	Mutual	0.88 (0.33)	0.65 (0.49)	0.85 (0.37)	0.80	(0.08)
	MM (SE)	0.40 (0.06)	0.30 (0.06)	0.40 (0.06)		

Note. Marginal means (MM) and standard error (SE) of interaction of Intentionality and Age and Group

Type and Age shown.

Figure 3*Joining as a Function of Intentionality, Age, and Group Type in Study 1*

Note. Children from ages 3- to 5-years old increasingly confer group joining based on mutual intentionality. 3-year-olds also rely on mutual intentions more to confer group joining than some single-sided intention types. Across intention types, 4-years-old children allow marginally less joining for family groups than other group types, but 5-year-olds allow less joining for friend groups. Error bars represent standard errors.

Discussion – Study 1

These results replicate previous work (Noyes & Dunham, 2017) demonstrating that young children use mutual intentionality to justify group membership by allowing novel individuals to join groups more when mutual intentions rather than single-sided intentions are used. Supporting our hypothesis (H₁), we find that 5-year-old children use this mutual intentionality framework significantly more than 3-year-olds. However, although 3-year-olds' causal use of mutual intentionality is lower than older children's, 3-year-olds allow more joining under mutual intentionality compared to individual-only intentions. Additionally, across groups, 3- and 4-year-olds appear to make a distinction between mutual and single-sided intention types, using single-sided intention types significantly below chance levels compared to using mutual intention types at chance level (see Supplemental Materials). Together, this suggests children as young as 3 may make a distinction between mutual versus single-sided intentionality types, demonstrating a preliminary understanding of mutual intentionality as causal to group joining. Thus, in contrast to our prediction (H₂), 3-year-old children were more rigid in their perceptions of group joining than hypothesized.

Finally, we found mixed evidence for our third hypothesis (H₃). Specifically, in opposition to our prediction, we found that all groups had higher joining rates under mutual intentionality. However, results also showed that 4-year-old children allowed less joining for a

family group (as the highly entitativized and essentialized group), yet, 5-year-olds showed the opposite pattern, allowing less joining for friend groups compared to family. These results were unexpected given evidence from past research that children demonstrate preferences towards family members and friends over strangers, suggesting a different developmental trajectory in understanding of these kind of intimacy groups over other kinds of groups (Olsen & Spelke, 2008). Notably, the stimuli of the family in Study 1 did not include “parents” as part of the depicted group. Thus, we hypothesized that children did not recognize the family group as a family, and perhaps viewed it instead as a task or friend group playing with the dog (e.g., Plötner et al., 2015; Tomasello et al., 2012; Trivers, 1971). Therefore, in Study 2, we redesigned our family group stimuli to include parental figures to increase the salience and prototypicality the family group (e.g., Gernhardt et al., 2013).

Methods – Study 2

Participants

Using the same power analysis considerations and recruitment methods as Study 1, 113 children from ages 3- to 5-years old were recruited for the study. Following the same pre-registered data exclusion guidelines for Study 1, data were excluded from analysis if the participant was unable to respond to a minimum of half of the trials ($n = 3$), and/or if the experimenter noted the participant was highly distracted or disengaged during the study ($n = 6$). Of included data, no participants skipped any of the nine trials. The final analyzed sample size included 104 children (44 boys, 60 girls, 0 non-binary or other gendered children; 80.8% White, 3.9% Multiracial/ethnic, 2.9% Black or African American, 3.8% Asian or Asian American, 5.8% Hispanic/Latino, 1.9% other race/ethnicity, and 0.96% race/ethnicity unknown) across the ages

of 3 ($n = 33$; $M_{\text{age}} = 3:7$ years, $SD = 0.29$, range = 3.00–3.98), 4 ($n = 33$; $M_{\text{age}} = 4:5$, $SD = 0.30$, range = 4.01–4.93), and 5 years ($n = 38$; $M_{\text{age}} = 5:5$ years, $SD = 0.23$, range = 5.06–5.81)⁵.

Stimuli, Design and Procedure

All stimuli and procedures were identical to Study 1 with two exceptions. First, because the original family group stimuli did not include prototypical family members such as parents, it was possible that children did not consider that particular stimuli as a family. For example, cross-culturally, young children include their parents in drawings of their families (Gernhardt et al., 2013). Thus, the Study 2 family stimuli included a set of parents to serve as a highly salient visual cue of a family unit (see Figure 4). All other stimuli remained the same. Secondly, to ensure that children fully understood the prompts and the intentionality and groups presented, Study 2 also asked children to justify their “yes” or “no” responses regarding group membership with the following prompt: “*Can you tell me why you think so?*”⁶

⁵ Age ranges based on DOB reporting from 73% of parents (data missing due to parent nondisclosure of DOB or ID matching error). Parent/guardian reported annual income: 43.3% did not complete the optional demographic form, 1.9% under \$25,000, 3.8% \$25,001–\$50,000, 6.7% \$50,000–\$75,000, 27.9% \$75,001–\$125,000, 16.3% over \$125,001. Parent/guardian reported educational attainment (mean percentages of Caregivers 1&2): $M = 47.1\%$ did not complete the optional demographic form, $M = 3.9\%$ High school or equivalent, $M = 2.9\%$ Community college/vocational school, $M = 21.2\%$ 4-year college/university degree, $M = 25.0\%$ professional/graduate school.

⁶ As some research has found that young children are not always able to distinguish between friends and family (Spokes & Spelke, 2018), an additional exploratory analysis was conducted of children’s verbal responses to these open-ended prompts in order to validate the testing procedure and offer additional insight on children’s causal reasoning about mutual intentionality and group membership. Please refer to the Supplemental Materials to view this analysis.

Figure 4*Study 2 Group Stimuli*

Note. New family group stimuli for Study 2 with the addition of two parents.

Results – Study 2 Joining Rates

Analysis Plan

Study 2 followed the same analysis plan as Study 1, which included group type (task group, friend group, *revised* family group), intentionality (individual-only, group-only, mutual), age group (3-, 4-, 5-years-olds), and all possible interactions. As in Study 1, a repeated measures linear model was used which revealed two significant effects described below.⁷

Main Effect of Intentionality and Interaction of Intentionality by Age

Replicating past work (Noyes & Dunham, 2017) and Study 1, Study 2 showed a significant main effect of intent, $F(2, 202) = 42.84, p < .001, \eta_p^2 = .30$. Again, replicating Study 1, the main effect of intentionality was qualified by the presence of a significant interaction between intentionality and participant age, $F(4, 202) = 3.72, p = .013, \eta_p^2 = .07$ (see Table 3). As in Study 1, simple effects analysis (Bonferroni correction) revealed that both 4- and 5-year-olds

⁷ Additionally, as in Study 1, an exploratory analysis was conducted in Study 2 to compare joining rates to chance. Please refer to the Supplemental Materials to view this analysis.

were more likely to permit joining when mutual intentions were used than when single-sided intentions were used (see Table 4 for means), $ps < .002$. Additionally, 3-year-olds also allowed marginally more joining with mutual intentionality over group-only intentionality, $p = .074$. Furthermore, although joining allowance under mutual intentionality did appear to increase between 3- to 5-years old, the rate of joining at 5- was not significantly higher than that at 3-year-olds, $p = .295$. However, joining rates under non-mutual intentionality did significantly decrease between 3- to 4-years old, $p = .029$ (see Figure 5).

Interaction of Group Type by Age and Group Type by Intentionality

In contrast to Study 1, there was no significant effect of group type by age, $F(4, 202) = 1.42$, $p = .229$, $\eta_p^2 = .03$, such that children did not differentially allow more or less joining based on group type across ages. Furthermore, there was no significant interaction between intentionality and group type, $F(4, 404) = 1.79$, $p = .138$, $\eta_p^2 = .02$. Regardless of group type, participants allowed more novel joining when mutual intentions were used rather than single-sided intentions (see Figure 5).

Table 3

Study 2 Repeated Measures ANOVA Results

Term	<i>df1</i>	<i>df2</i>	<i>F</i>		<i>p</i>	η_p^2	
Age		Between Subjects	2	101	0.81	.446	0.02
Group Type		Sphericity Assumed	2	202	0.57	.566	0.01
		Greenhouse-Geisser	1.82	183.83	0.57	.550	0.01

Intent***	Sphericity Assumed	2	202	42.84	<.001	0.30
	Greenhouse-Geisser	1.52	153.25	42.84	<.001	0.30
Group Type by Age	Sphericity Assumed	4	202	1.42	.229	0.03
	Greenhouse-Geisser	3.64	183.83	1.42	.233	0.03
Group Type by Intent	Sphericity Assumed	4	404	1.79	.131	0.02
	Greenhouse-Geisser	3.60	363.24	1.79	.138	0.02
Intent by Age*	Sphericity Assumed	4	202	3.72	.006	0.07
	Greenhouse-Geisser	3.04	153.25	3.72	.013	0.07
Group Type by Intent by Age	Sphericity Assumed	8	404	1.39	.201	0.03
	Greenhouse-Geisser	7.19	363.24	1.39	.209	0.03

Note. * $p < .05$, ** $p < .01$, *** $p < .001$; Mauchly's Test of Sphericity indicated that the assumption of sphericity was violated for the predictor of Intentionality, $\chi^2(2) = 38.29$, $p < .001$, Group Type, $\chi^2(2) = 10.41$, $p = .005$, and the interaction of Intentionality and Group, $\chi^2(9) = 24.49$, $p = .004$. Therefore, the Greenhouse-Geisser correction was used across specific tests (terms in bold are those interpreted).

Table 4

Study 2 Means (M) and Standard Deviations (SD) of Joining Rates by Age, Intention, Group

		Task Group		Friend Group		Family Group			
Intentionality		M (SD)		M (SD)		M (SD)		MM (SE)	
3-years-old	Individual-only	0.30	(0.47)	0.18	(0.39)	0.33	(0.48)	0.27	(0.05)
	Group-only	0.27	(0.45)	0.18	(0.39)	0.24	(0.44)	0.23	(0.06)
	Mutual	0.36	(0.49)	0.48	(0.51)	0.39	(0.50)	0.41	(0.08)
	MM (SE)	0.31	(0.05)	0.28	(0.05)	0.32	(0.05)		
4-years-old	Individual-only	0.09	(0.29)	0.12	(0.33)	0.06	(0.24)	0.09	(0.05)
	Group-only	0.09	(0.29)	0.18	(0.39)	0.15	(0.36)	0.14	(0.06)
	Mutual	0.45	(0.51)	0.45	(0.51)	0.39	(0.50)	0.43	(0.08)
	MM (SE)	0.21	(0.05)	0.25	(0.05)	0.20	(0.05)		
5-years-old	Individual-only	0.16	(0.37)	0.08	(0.27)	0.05	(0.23)	0.10	(0.05)
	Group-only	0.16	(0.37)	0.11	(0.31)	0.16	(0.37)	0.14	(0.05)
	Mutual	0.63	(0.49)	0.61	(0.49)	0.53	(0.51)	0.59	(0.07)
	MM (SE)	0.32	(0.05)	0.26	(0.05)	0.25	(0.05)		

Note. Marginal means (*MM*) and standard error (*SE*) of interaction of Intentionality and Age and Group Type and Age shown.

Figure 5

Joining as a Function of Intentionality, Age, and Group Type in Study 2

Note. Study 2 replicated the interaction found in Study 1 between intentionality type (individual-only, group-only, mutual) and participant age (3-, 4-, 5-years-old). Children ages 4 and 5 significantly relied on mutual intentionality as a causal framework for recognizing group membership. Further, 3-year-olds marginally relied on mutual intentionality over group-only intentionality. As in Study 1, the results showed no significant interaction between intentionality and group type, such that all groups (task, friends, family) were allowed equal rates of joining under mutual intentions. Error bars represent standard errors.

Discussion – Study 2 Joining Rates

Replicating Study 1 and previous research (Noyes & Dunham, 2017), 4- and 5-year-olds were significantly more likely to rely on mutual intentionality as causal to group joining than single-sided intentionalities. As in Study 1, 3-year-old children also demonstrated emerging usage of the mutual intentionality framework, marginally allowing more joining under mutual intentions than some single-sided intentions. Also, like Study 1, 3- to 5-year-olds appear to make a distinction between mutual and single-sided intention types, using single-sided intention types significantly below chance levels compared to mutual intentions at chance (see Supplemental Materials). Alongside Study 1, this suggests that children as young as 3-years-old may in part cognitively differentiate between intentionality types to constitute group membership. Further, by age 4, however, children appear to significantly decrease any usage of single-sided intentions as constitutive to group joining. These data suggest that across ages 3-5, children developmentally become more aware of mutual intentions as causal to group membership. Additionally, as in Study 1, our hypothesis that the more entitativized and essentialized group (e.g. family) would be more restricted in their group joining was not supported. Our results show that joining rates did not differ across group types, and overall, any type of group was conferred more joining under mutual intentionality than single-sided intentions.

General Discussion

Social groups carry powerful informational cues (Rhodes & Chalik, 2013; Schmidt et al., 2012). However, for social groups to exist, individuals must categorize others as members or non-members of groups. Here, we provide new evidence for mutual intentions being a guiding

principle of group formation as early as 3 years of age and across three distinct group types with varying entitativized and essentialized qualities.

In line with previous research (Noyes & Dunham, 2017), we expected that older children would more readily apply a mutual intentionality framework as causal justification for group membership than younger children. Supporting this hypothesis, results from two studies demonstrate that 4- and 5-year-olds rely on mutual intentions more than single-sided intention types (individual-only or group-only). And in an extension of previous research, we also show that children already begin to distinguish between mutual and single-sided intentionality as young as 3-years-old. This distinction between intentionality types may be evidence of an early cognitive understanding that expressions of mutual intentionality, and not single-sided intentionality, can serve as justification for categorizing individuals into groups. Furthermore, the use of mutual intentionality justifications, rather than single-sided intentionality, strengthens with age such that 3-year-olds demonstrate an emerging understanding of this difference and 4-year-old subsequent to 5-year-old children demonstrate an increasingly stronger reliance on mutual intentions to determine group membership.

Beyond experimentally constructed minimal groups, in this study we tested whether mutual intentions differentially affected group joining based on realistic group types with varying essentialized and entitativized qualities for the first time (e.g., Lickel et al., 2000, 2001; Svirydzenka et al., 2010; Plötner et al., 2016). We show that across three different groups: one with high entitativity and essentialized qualities (family), one with high entitativity and perhaps lower essentialism (friends), and a high entitativity group with no essentialism (task group), young children employ a mutual intentionality framework such that they think that an individual can join a group when both the novel solo character and the group mutually agree to the joining.

Extending previous work, young children appear to rely on a mutual intentionality framework not only towards understanding minimal groups (Noyes & Dunham, 2017), but also to realistic social groups like task, friends, and family groups.

We had hypothesized that the family group would be perceived differently than other intimacy groups under a mutual intentionality framework as the family group possess both entitativity (e.g., “groupedness”) and essentialized qualities (e.g., biological kinship), making the boundaries of this group more rigid, and thus harder to join. However, we find across two studies that allowance of joining remains highest under mutual intentionality (as compared to single-sided intentionality) across all three group types. As all three groups had highly entitativized qualities, this may have privileged the application of mutual intentionality given the conceptualizations of entitativity and mutual intentionality being both related to perceived common goals (e.g., Campbell). Moreover, young children may instead be preferencing the mutual intentionality expressed between individuals and groups over some group-specific qualities (essentialism) as causal to group joining. Where previous research has suggested that children disparately apply mutual intentions towards non-essentialized and highly-essentialized groups (Noyes & Dunham, 2017), the present study suggests for the first time that children also apply a mutual intentionality framework towards realistic social groups with entitativized and essentialized qualities.

Limitations and Future Research

Notably, children’s social microsystems expand as they begin school such that the saliency of family and friends as intimacy groups and the way children perceive these groups may change as children age. As previous work has identified the use of mutual intentions amongst children up to 9-years-old (Noyes & Dunham, 2017), future research should test older

cohorts of children who might more readily recognize differences in entitativity between realistic groups (e.g., Lickel et al., 2001; Svirydzenka et al., 2010). Moreover, as children come to better understand the unique properties of family (e.g., biological kinship), essentialization of this group might increase with age. Thus, children's use of a mutual intentionality framework may decrease when applied towards this group as children age. Future research should also consider individual differences that may affect how participants perceive the different group types. For example, would adopted children, children with adopted siblings, or children with a step-parent(s) perceive family group boundaries to be more permeable than children who have only biological parents and siblings? It is also possible that children's conception of family or kinship is more like a fictive kinship (Ibsen & Klobus, 1972), that is not based on genetic or affinal ties (e.g., marriage), but rather mutually constructed social-relational bonds (e.g., a godparent). Thus, in this set of studies, it remains unclear whether children perceived the family group to have essentialized qualities or not. Future work should consider including more direct measures of children's perception of essentialized qualities of different group types.

It is also important to note that mutual intentionality may be communicated through body language or other social behaviors, rather than as an overt statement as used in the present work. Thus, research should consider how children interpret more implicit communications of mutual intentionality within social interactions and how individuals may carry distinct qualities, identities, or characteristics that may signal category membership more saliently. Additionally, the way these intentions are verbally communicated to children should also be considered further. In the present study, the use of terms "want" (which may signal one's desires) and "can't" (which may signal one's ability) were both used in all three types of intention statements. These terms were used based on the language in research by Noyes & Dunham (2017). However,

in this previous research, the individual communicated what they wanted (“[Name] says s/he wants to be in a [Group]”), while the group communicated what could happen (“[Groups] say [Name] can be a [Group]”). As mutual intentions imply shared desires, we decided to vary the use of term “want” to be used by both the individual and group at different times. Future work might consider if subtle shifts in language used by an individual or group may differentially impact children’s perception of intentionality.

Finally, race and gender were held constant in our stimuli and it was beyond the purview of this study to test for the role that children’s own essentialized identities (e.g., gender and race) may play in shaping mutual intention applications. Past research shows that girls and women are more likely than boys and men to actively include novel members into existing social groups, which could influence the age or degree to which girls versus boys permit group joining even under mutual intentions (Carli, 2013). Regarding race, Black children’s increased likelihood to experience racial discrimination compared to White children (Brody et al., 2006; Goff et al., 2014), may lead to differing perceptions of group boundaries and social rules, especially as a function of whether the group or joiner are from a majority versus minority racial group (Tatum, 2017). Therefore, more research is necessary to test the boundary effects of children’s use of a mutual intentionality framework by considering participants’ own social identities and the application of this cognitive perspective to other essentialized groups (e.g., race; Prentice & Miller, 2007). Furthermore, as infants begin to make categorical social group distinctions as early as 3-months-old (between genders, Quinn et al., 2002; 6-months-old between racial groups, Katz & Kofkin, 1997), additional research might explore whether even younger children display other basic understandings of mutual intentionality.

Conclusions

Taken together, the present work contributes to the literature on naïve sociology (Hirschfeld, 1996; Olson & Dweck, 2008) by demonstrating that the mutual intentionality framework may have causal relevance for young children's categorization of not only minimal groups (e.g., Noyes & Dunham, 2017), but entitative groups (e.g., task, friends, family) and perhaps even some essentialized groups (e.g., family). Further, we observe a developmental trend for reliance on this framework such that as young as 3-years-old, children demonstrate an early understanding of mutual intentionality towards allowing group joining. By 4-years-old, children diminish their use of other intentional justifications in favor of mutual intentionality across group types. And by age 5, children significantly increase their reliance on mutual intentionality as a causal framework to constitute group formation. In sum, we highlight that children younger than previously thought—3-years-old—show emerging usage of mutual intentions as a causal pathway for group membership, and highlight the robust application of this cognitive framework towards various types of realistic groups.

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Who Can Be in a Group? 3- to 5-Year-Old Children Construe Realistic Social Groups Through Mutual Intentionality

Supplemental Materials

This Supplemental Materials document details additional exploratory analyses. First, one-sample t-tests were performed on joining rates in Study 1 to compare these rates to chance. This same analysis was repeated on Study 2 data. Additionally, another exploratory analysis was conducted on Study 2 data to test children's comprehension of the study procedures.

Joining Rates Comparison to Chance – Study 1 and 2

Results

Study 1. One-sample t tests were used to compare joining rates across the three intentionality types and three group types to chance (0.50). This analysis revealed that across task and family groups, 3- and 4-year-old children allowed group joining using mutual intentionality at chance levels but used single-sided intentions types to allow group joining below chance levels, $ps < .05$. Moreover, 5-year-olds also used single-sided intentionality types significantly below chance levels, $ps < .001$, and also used mutual intentionality significantly above chance for both task and family groups, $ps < .001$. For the friend group, 3-year-old children used all three intention types significantly below chance, however, 4- and 5-year-olds were at chance levels for mutual intention use and remained below chance levels for single-sided intention types (see Table 1).

Study 2. One-sample t-tests were used again to compare joining rates to chance levels (0.50) across the three intentionality and group types. Across all three group types, 3- and 4-year-old children allowed group joining using mutual intentionality at chance levels, $ps > .100$, but used single-sided intentions types to allow group joining significantly below chance levels, $ps <$

.05 (with one exception of 3-year-old using individual-only intentionality marginally below chance). 5-year-olds demonstrate this same pattern for the friend and family group. For the task group, 5-year-olds also used single-sided intentions significantly below chance levels, $ps < .001$, and used mutual intentionality marginally above chance (see Table 2).

Table 1

Study 1 Means (M) and Standard Deviations (SD) of Joining Rates by Age, Intention, Group Comparison to Chance

	Intentionality	Task Group					Friend Group				Family Group				MM (SE)
		M (SD)	t	df	d		M (SD)	t	df	d	M (SD)	t	df	d	
3-years-old	Individual-only	0.16 (0.37)	-5.04***	30	0.91		0.23 (0.43)	-3.59***	30	0.65	0.10 (0.30)	-7.47***	30	1.34	0.16 (0.06)
	Group-only	0.19 (0.40)	-4.25***	30	0.76		0.23 (0.43)	-3.59***	30	0.65	0.29 (0.46)	-2.53*	30	0.45	0.24 (0.06)
	Mutual	0.52 (0.51)	0.18	30	0.03		0.32 (0.48)	-2.08*	30	0.37	0.35 (0.49)	-1.66	30	0.30	0.40 (0.07)
	MM (SE)	0.29 (0.05)					0.29 (0.06)				0.25 (0.05)				
4-years-old	Individual-only	0.19 (0.40)	-4.76***	36	0.78		0.14 (0.35)	-6.40***	36	1.05	0.14 (0.35)	-6.40***	36	1.05	0.16 (0.05)
	Group-only	0.22 (0.42)	-4.14***	36	0.68		0.27 (0.45)	-3.10***	36	0.51	0.14 (0.35)	-6.40***	36	1.05	0.21 (0.06)
	Mutual	0.62 (0.49)	1.51	36	0.25		0.65 (0.48)	1.87^	36	0.31	0.57 (0.50)	0.82	36	0.14	0.63 (0.07)
	MM (SE)	0.35 (0.05)					0.36 (0.05)				0.29 (0.05)				
5-years-old	Individual-only	0.12 (0.33)	-6.02***	25	0.33		0.15 (0.37)	-4.80***	25	0.37	0.15 (0.37)	-4.80***	25	0.37	0.14 (0.06)
	Group-only	0.19 (0.40)	-3.90***	25	0.40		0.08 (0.27)	-7.94***	25	0.27	0.19 (0.40)	-3.90***	25	0.40	0.15 (0.06)
	Mutual	0.88 (0.33)	6.02***	25	0.33		0.65 (0.49)	1.62	25	0.49	0.85 (0.37)	4.80***	25	0.37	0.80 (0.08)
	MM (SE)	0.40 (0.06)					0.30 (0.06)				0.40 (0.06)				

Note. Marginal means (MM) and standard error (SE) of interaction of Intentionality and Age and Group Type and Age shown. The t values show comparison to chance levels of joining (50%).

* $p < .05$, ** $p < .01$, *** $p < .001$, ^ $p < .10$

Table 2*Study 2 Means (M) and Standard Deviations (SD) of Joining Rates by Age, Intention, Group**Comparison to Chance*

	Intentionality	Task Group				Friend Group				Family Group				MM (SE)	
		M (SD)	t	df	d	M (SD)	t	df	d	M (SD)	t	df	d		
3-years-old	Individual-only	0.3 (0.47)	-2.43*	32	0.47	0.18 (0.39)	-4.67***	32	0.39	0.33 (0.48)	-2.00^	32	0.48	0.27 (0.05)	
	Group-only	0.27 (0.45)	-2.89**	32	0.45	0.18 (0.39)	-4.67***	32	0.39	0.24 (0.44)	-3.40**	32	0.44	0.23 (0.06)	
	Mutual	0.36 (0.49)	-1.60	32	0.49	0.48 (0.51)	-0.17	32	0.51	0.39 (0.50)	-1.23	32	0.50	0.41 (0.08)	
	MM (SE)	0.31 (0.05)				0.28 (0.05)				0.32 (0.05)					
4-years-old	Individual-only	0.09 (0.29)	-8.05***	32	1.40	0.12 (0.33)	-6.57***	32	1.14	0.06 (0.24)	-10.42***	32	1.81	0.09 (0.05)	
	Group-only	0.09 (0.29)	-8.05***	32	1.40	0.18 (0.39)	-4.67***	32	0.81	0.15 (0.36)	-5.50***	32	0.96	0.14 (0.06)	
	Mutual	0.45 (0.51)	-0.52	32	0.09	0.45 (0.51)	-.52	32	0.09	0.39 (0.50)	-1.23	32	0.21	0.43 (0.08)	
	MM (SE)	0.21 (0.05)				0.25 (0.05)				0.2 (0.05)					
5-years-old	Individual-only	0.16 (0.37)	-5.91***	38	0.95	0.08 (0.27)	-9.79***	38	1.57	0.05 (0.23)	-12.54***	38	2.01	0.1 (0.05)	
	Group-only	0.16 (0.37)	-5.91***	38	0.95	0.11 (0.31)	-8.08***	38	1.29	0.16 (0.37)	-5.91***	38	0.95	0.14 (0.05)	
	Mutual	0.63 (0.49)	1.81^	38	0.29	0.61 (0.49)	1.46	38	0.23	0.53 (0.51)	0.16	38	0.03	0.59 (0.07)	
	MM (SE)	0.32 (0.05)				0.26 (0.05)				0.25 (0.05)					

Note. Marginal means (MM) and standard error (SE) of interaction of Intentionality and Age and Group Type and Age shown. The *t* values show comparison to chance levels of joining (50%).

* $p < .05$, ** $p < .01$, *** $p < .001$, ^ $p < .10$

Discussion – Comparisons to Chance

Across both studies, there is consistent evidence that 5-year-olds understand mutual intentionality because they use it above chance levels particularly when looking at a non-essentialized group (task group). This is in line with Noyes & Dunham (2017), but also extends their previous work by showing for the first time that children use mutual intentionality to understand joining for an entitativized group as well. Although the 3- and 4-year-olds only use mutual intentionality at chance levels, there are also using the non-mutual intentionality types significantly below chance levels. This suggests that they are differentiating between mutual and

non-mutual intention types and may be evidence of an early understanding of the mutual intentionality framework. That is, although 3- and 4-year-olds may not understand yet that mutual intentions always mean a new individual can join a group, they may understand that non-mutual intentions does mean a new individual *cannot* join a group. This may be an early cognitive step to fully understanding mutual intentionality.

Comprehension/Intentionality Coding & Group Label Text Analysis – Study 2

Children's responses to the open-ended prompts were recorded and later coded by two research assistants (1 Black female, 1 Asian non-binary person). This addition was exploratory with the goal to provide additional evidence for children's overall comprehension of the study design and questions as well as to identify any language markers reflecting use of intentionality in children's vocalized causal reasoning. Responses from 60 participants were coded.⁸

Coders read each participants' nine responses and coded for an overall impression of the participant's comprehension of the prompt (1 = understood, 0 = did not understand). Specifically, coders looked for evidence that the participants understood the question such that they could articulate some type of justification or reasoning for their decisions regarding group joining or non-joining (e.g., "yes because they wanted him and he said yes;" "cause mom and dad;" "because he wants to build with them") versus a response that did not indicate that the participant understood the study question (e.g., no response recorded, "I don't know;" "not sure")⁹. Additionally, coders rated participant responses that included mentions of intentionality regarding group-joining (1 = intentionality mentioned, 0 = no intentionality mentioned). Here,

⁸ Some open-ended responses missing due to (i) experimenter error such as follow-up question not asked or subject ID not recorded, $n = 35$, or (ii) misplacement of study transcription materials $n = 9$.

⁹ Coders made their judgements about participant understanding by considering all nine responses from each participant. This was done as responses may be related to and even depend on one another (e.g., some children shortened their verbal explanations across trials). Thus, without looking at all nine responses, some responses could appear ambiguous out of context to the entire profile of responses.

coders looked for evidence that the participants may have considered intentionality of the characters in their reasoning about group-joining (e.g., “no, they don’t want him to be in the family;” “the children said he can”) versus a response that did not mention intentions (e.g., “no idea;” “because he has grey pants”).

Furthermore, some research suggests that young children may not readily differentiate between siblings and friends (Spokes & Spelke, 2018), so it is possible that participants in Study 1 were not viewing the prescribed categories as intended by the researchers (e.g., confusing the family as a friend group). To account for this, we conducted a text-analysis of the open-ended participant responses from Study 2 to assess the language being used in reference to the different group conditions as a proxy of the children’s understanding of each group’s intended categorization.

Results – Study 2 Coding

Comprehension/intentionality coding. Coders read each participants’ nine responses and coded for an overall impression of the child’s comprehension of the prompt and inter-rater reliability was good overall and at each age group, $K_{overall} = .77, p < .001$, $K_{3-year-olds} = .85, p < .001$, $K_{4-year-olds} = .65, p = .001$, $K_{5-year-olds} = .64, p = .004$. Across all age groups, the two coders agreed that an average of 87.5% of participants were able to verbally express comprehension of the prompt significantly more than chance levels, $t(59) = 9.25, p < .001, d = 1.19$. Furthermore, at each age group, ratings of average understanding also significantly exceeded chance levels ($M_{3-year-olds} = .74, t(16) = 2.22, p = .04, d = .54$, $M_{4-year-olds} = .94, t(24) = 10.01, p < .001, d = 2.00$, $M_{5-year-olds} = .92, t(17) = 6.87, p < .001, d = 1.62$). This suggests that the participants, across age groups, comprehended the experimental design and question of interest.

Coders also read each participants' nine responses and coded for indications of the characters' intentions about group joining (e.g., "he wants to be in the family but can't"). However, inter-rater reliability was only marginal overall, $K_{overall} = .233, p = .065$, and particularly low for all age groups except for 5-years-old which was also marginal, $K_{5-year-olds} = .446, p = .058$. As verbal skills and comprehensibility are still developing significantly between ages 3-5 (e.g., Conti-Ramsden & Durkin, 2012; Hendriks, 2014), the coding scheme may not have adequately reflected differences between age groups. Thus, only 5-year-olds were included in further analyses. At age 5, the two coders agreed that an average of 72.2% of participants were able to verbally express the intentionality of the characters significantly more than chance levels $t(17) = 2.41, p = .028, d = .57$.

Group label text analysis. From each of the category conditions (e.g., task group, friends, family), the researchers read the free-response data for keywords that could be used to accurately label and identify the different group types (e.g., the children might reference the family group specifically by saying "parents" or "mom" or "dad"). With the list of identified keywords (see Table 3), the frequency of these terms in the free-response data were analyzed. Chi-square analysis revealed that across group types, children spontaneously produced the label for the condition being tested (e.g., used family keywords like "mom" more in the family condition than other conditions) significantly more often than any other group labels (Builders: $\chi^2(4,47) = 94.00, p < .001$; Friends: $\chi^2(4,36) = 72.00, p < .001$; Family: $\chi^2(1, 35) = 35.00, p < .001$). This suggests that children were identifying the group types as intended. Notably, as the children were not instructed to name the groups they were viewing, the low overall rate of keywords produced is likely not indicative of children misunderstanding the group type or task.

Table 3*Frequency of Participant Produced Keywords by Group Type (Study 2)*

Keywords	Task (Builders)	Friend	Family
	Condition	Condition	Condition
"Friend[s]"	9	29	9
"Builder[s]" "Build[ing]"	32	1	0
"Family" "Parent[s]" "Mom/Dad"	6	6	26

Note. Keywords were selected after searching all open-ended responses for potential labeling terms. Participants were more likely to produce condition-congruent words than condition-incongruent words across the three group types.

Discussion – Study 2 Coding

We found that an average of 87.5% of participants were able to verbally express comprehension of the prompt and 72.2% of 5-year-olds could verbally express causal reasoning involving intentionality of the characters. Additionally, children were more likely to produce a congruent group label (e.g., referencing “family” during the family group trials) than an incongruent label across the three group types. This supports the comprehensibility of the study design, particularly with such a young age group, and also provides additional evidence of the robust use of the mutual intentionality framework by age 5.