# Children Expect People to Accurately Represent the Minds of Their Close Social Partners

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**Abstract**

Do children reason that people in close relationships accurately represent each other's minds? In two experiments (total $N$ = 123), we found that 7- to 9-year-old children from the US (i) reason that people who are close will accurately represent each other's goals and desires and (ii) infer that people are socially close when they accurately predict each other's emotional states. These findings suggest that children reason flexibly about mental state attributions within close relationships.

**Keywords:** relationships; affiliation; cognitive development

## Introduction

To maintain and develop close relationships, people often need to represent the minds of their social partners. For example, to help one's social partner achieve their goals, one must represent those goals (Baker et al., 2009; Woo et al., 2023; Woodward, 2009), and to learn from one's social partner, one must represent what they are trying to do or teach (Gweon, 2021). A growing body of research suggests that children have an intuitive theory of social relationships that allows them to make sense of social behavior and infer how people will behave toward each other (Powell, 2022; Thomas et al., 2022). Here, we investigate whether children's theory of relationships includes the intuition that people in close relationships accurately represent each other's minds.

### Children's Understanding of Close Relationships

A large body of research has investigated children's understanding of relationships. Afshordi and Liberman (2020) reviewed this literature and identified three cues that children use to infer friendship: the amount of time spent together; whether people are prosocial to each other (e.g., sharing, comforting); and whether people share preferences. Recent research suggests that 4- to 7-year-old children also recognize empathy as a cue to friendship (Smith-Flores et al., 2023). These studies demonstrate that children can infer friendship from observing others' social behaviors.

Based on whether people are friends, kin, rivals, or strangers, children also make predictions about whether people will share (Olson & Spelke, 2008), be comfortable eating food that may have contacted someone else's saliva (Thomas et al., 2022), and feel empathy towards each other (Smith-Flores et al., 2023). Thus, children infer how people will behave based on their relationships.

Although some of this work suggests that children understand that people share goals and emotions with close others, there are many situations in which people need to represent the minds of close others as distinct from their own. By accurately representing a friend's goal, one can better help them. By representing their emotional state, one can respond more appropriately. It is unknown how children think about mental state attributions within close relationships.

The present experiments seek to determine whether 7- to 9-year-old children (i) reason that people who are close will accurately represent each other's goal states and desires and (ii) infer social closeness when people accurately predict each other's emotional states. We chose to test 7 to 9-year-old children because past research has explored children's understanding of friendship in this age range. If 7- to 9-year-old children succeed, their performance can serve as a comparison point in studies of younger children.

## Experiment 1

We first needed a way to establish closeness. Research suggests that, across cultures, people within close relationships engage in affective touch (Sorokowska et al., 2021; Suvihlehto et al., 2019). Thus, we presented children with videos in which one character touched a protagonist (as though nuzzling) and another character engaged in the same coordinated movements but without touching. We then asked children questions concerning (i) how close the protagonist was to the characters and (ii) which character would be more likely to know the protagonist's goals and desires.

If children think that affective touch occurs within close relationships and that people are more likely to accurately represent the minds of close others, then they should rate the character who had touched the protagonist as being more likely to know the protagonist's goals and desires.

### Method

Hypotheses, methods, and analyses for Experiments 1 and 2 were preregistered on the Open Science Framework. The preregistrations, stimuli, data, and code are hosted at: https://osf.io/kaz4n/. We conducted Experiment 2 before conducting Experiment 1; we present them in this order for narrative purposes.

**Participants** Sixty-five 7- to 9-year-old US American children (mean age = 8.41 years, range = 7.00 to 9.94 years,



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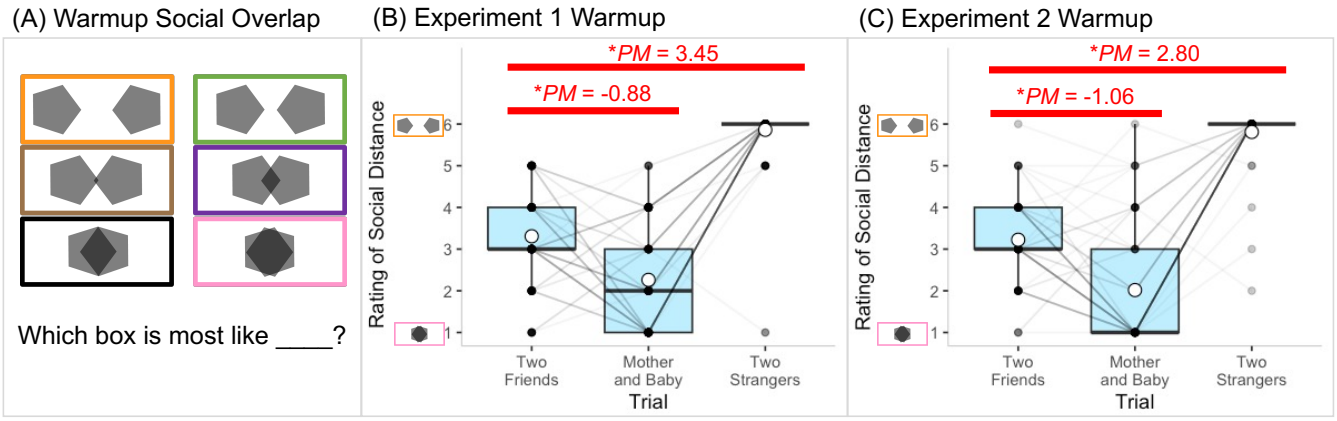


Figure 1: The social overlap warmup (A) and children's ratings on the warmup (B, C) in Experiments 1 and 2. White circles indicate means, horizontal lines within boxes indicate medians, connected dots indicate data from a single child, and boxes indicate interquartile ranges. *PM* indicates posterior medians, and asterisks indicate that 0 is not in the 95% credible interval.

33 girls and 32 boys) were tested online over video calls. We recruited participants through the lab database, social media, and Lookit. To determine a target sample size, we performed two power simulations: one on Experiment 2's data ($n$ = 58) and one on pilot data ($n$ = 8) collected using the methods for Experiment 1. More families responded than anticipated to recruitment, so we had 9 extra participants. We had full data from all but one participant, who was distracted. All participants were tested with their caregivers' consent and the participants' verbal assent.

**Procedure** The procedure consisted of a warmup, a familiarization phase, and a test phase. In the warmup, we presented participants with a measure of social overlap (Fig. 1A), building on work by Aron et al. (1992). The measure included six pairs of pentagons: a 6-point scale. The overlap between pentagons varied (1 = mostly overlapping, 6 =no overlap). Participants indicated which pair best represented a mother and a baby, two strangers, and two friends. Smith-Flores et al. (2023) have used a similar scale to ask children about how much people like each other.

In familiarization, the experimenter presented children with three individuals: a protagonist (red circle) and two characters on the side (blue square and yellow triangle). The experimenter played two videos, in which the protagonist either (i) turned to and touched one of the other characters or (ii) only turned to the remaining character (Fig. 2A).

Next, the experimenter probed children's understanding of the characters' relationships (Fig. 2). First, the experimenter asked children to indicate which pentagons in the social overlap scale best represented the relationship between the protagonist and each character. Second, following work by Liberman and Shaw (2017, 2018, 2019), the experimenter asked children about which character was better friends with the protagonist. Third, the experimenter explained that the protagonist had a secret and asked children how likely it was that the protagonist told each character, using a 4-point scale (1 = definitely no, 4 = definitely yes). Lastly, the experimenter asked children to guess which character would hug the protagonist when the protagonist was distressed.

In the test phase, each child saw three test trials and two control trials (Fig. 3A). For each test trial, the experimenter explained that the protagonist had some goal or desire (e.g., wanting a muffin, liking a ball). The goal or desire was only presented as a thought bubble; it could not be inferred from the protagonist's behavior (i.e., it was unobservable). The experimenter asked children to guess the likelihood that each character knew of the protagonist's goal or desire, using the same 4-point scale as in the secret-sharing measure. The experimenter then told children that one character knew the protagonist's goal or desire, and asked children to guess which character knew (forced choice).

We designed the control trials to address whether children thought that the character who had touched the protagonist was more likely to know anything. The first control trial was about a state of the world: whether it would rain. The second control trial was about a goal that the protagonist acted on: The experimenter played a video in which the protagonist moved to a teddy bear over a donut, with both characters present to witness the choice. The experimenter explained that the protagonist liked the teddy bear more than the donut. Following each control trial, the experimenter asked children about the likelihood that each character knew the content of the trial. For the first control trial, the experimenter asked children to select which character knew the content. The second control trial did not include this question, as both characters had observed the protagonist's actions.

**Counterbalancing** We counterbalanced which character touched the protagonist (square or triangle) and the side of that character (left or right). The left character always went first or was asked about first across trials. There were 4 versions of the stimuli, and participants were randomly assigned to a version.

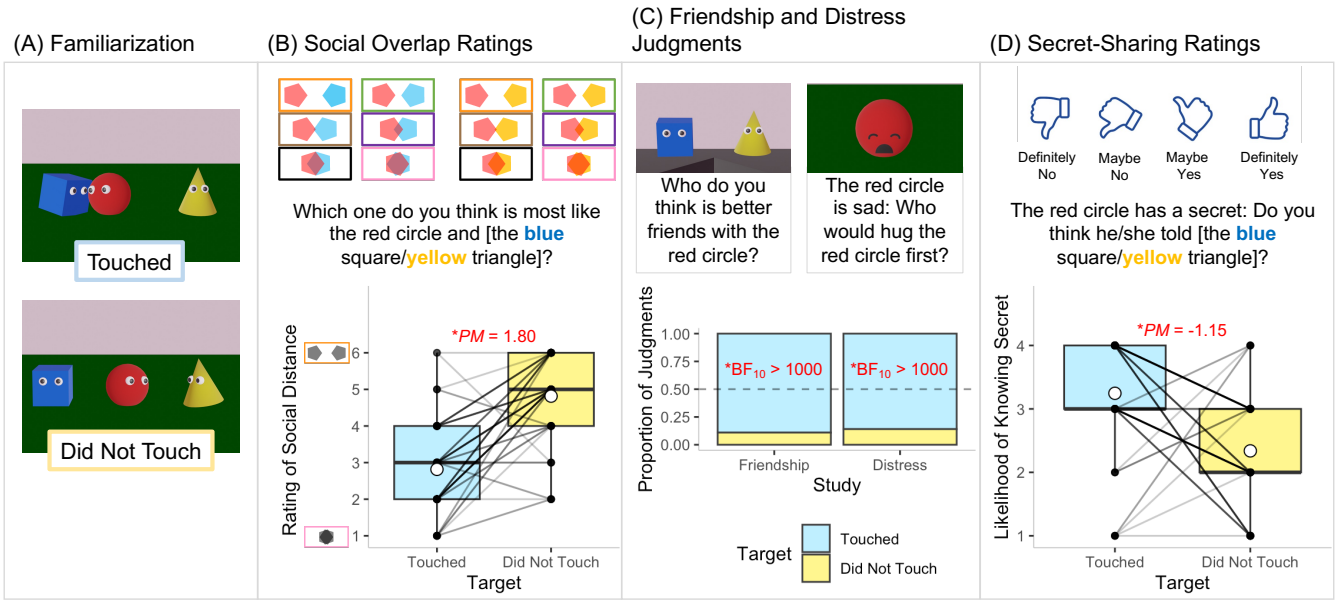


Figure 2: Familiarization stimuli (A) and children's social overlap ratings (B), friendship and distress judgments (C), and secret-sharing ratings (D) in Experiment 1. Across panels, blue indicates responses concerning the character who had touched the protagonist, and yellow indicates responses concerning the character who did not. *PM* indicates posterior medians, $BF_{10}$ indicates the Bayes Factor, and asterisks indicate that 0 is not in the 95% credible interval or that $BF_{10}$ exceeded 8. For plots in panels B and D, white circles indicate means, horizontal lines within boxes indicate medians, pairs of connected dots indicate data from a single child, and boxes indicate interquartile ranges.

## Results

**Social Overlap** We first confirmed whether children used the warmup scale correctly. We conducted a preregistered Bayesian cumulative probit mixed-effects model, with default priors, appropriate for ordinal data. The dependent variable was the overlap rating, the fixed effect was the target (mom-baby, strangers, and friends), and participant ID was a random effect. We used dummy coding, with the friends as the reference group. The target predicted the overlap rating (Fig. 1B): Children rated (i) a mother and her baby (median = 2, IQR [1, 3]) as closer than two friends (median = 3, IQR [3, 4]) are (posterior median (*PM*) = -0.88, 95% CI [-1.25, -0.50], 0% in region of practical equivalence, ROPE); and (ii) two friends as closer than two strangers (median = 6, IQR [6, 6]) are (*PM* = 3.45, 95% CI [2.77, 4.31], 0% in ROPE).

We next examined whether children inferred that the characters who had touched were closer in this scale. We conducted a preregistered Bayesian cumulative probit mixed-effects model, with default priors. The dependent variable was the overlap rating; the fixed effect was whether a character had touched the protagonist; and participant ID was a random effect. Children rated the character who had touched the protagonist (median = 3, IQR [2, 4]) as being closer than the character who had not (median = 5, IQR [4, 6]) (*PM* = 1.80, 95% CI [1.37, 2.29], 0% in ROPE) (Fig. 2B).

**Friendship and Distress Judgments** We examined children's forced-choice answers concerning who was better friends with and would be more likely to hug the protagonist. To do so, we used preregistered Bayesian binomial tests, with default priors. The children answered that the character who had touched was better friends with the protagonist (58/65 children, $BF_{10} > 1000$) and would hug the protagonist (56/65 children, $BF_{10} > 1000$) (Fig. 2C).

**Secret-Sharing** We next examined children's ratings of the likelihood that the protagonist told each character a secret. We conducted a preregistered Bayesian cumulative probit mixed-effects model, with default priors. The dependent variable was the likelihood rating; the fixed effect was whether a character had touched the protagonist; and participant ID was a random effect. Children rated the protagonist as being more likely to have told the character who had touched the protagonist (median = 3, IQR [3, 4]) over the character who did not (median = 2, IQR [2, 3]) (*PM* = -1.15, 95% CI [-1.56, -0.76], 0% in ROPE) (Fig. 2D).

**Knowledge of Goals and Desires** Finally, we examined children's ratings of the likelihood that a character knew of the protagonist's unobservable goal states and desires in test trials. We ran a preregistered Bayesian cumulative probit mixed-effects model, with default priors. The dependent variable was the likelihood rating. The fixed effects were the trial type (test vs. control), target (touched vs. did not touch), and the resulting interaction. The fixed effects were centered, and participant ID was a random effect.

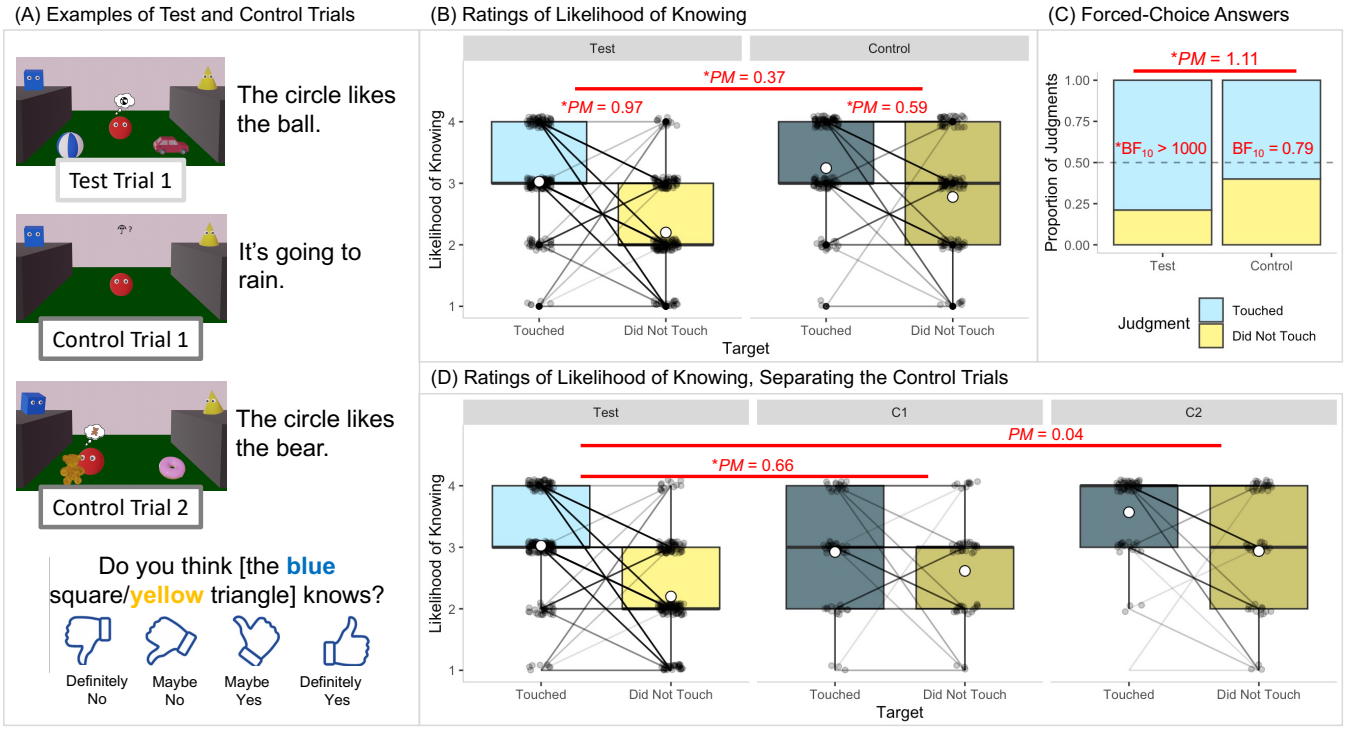


Figure 3: Example trials (A) and children's ratings (B, D) and answers (C) concerning the characters' knowledge in Experiment 1. Across panels, blue indicates responses concerning the character who had touched the protagonist, and yellow indicates responses concerning the character who did not. *PM* indicates posterior medians, $BF_{10}$ indicates the Bayes Factor, and asterisks indicate that 0 is not in the 95% credible interval or that the Bayes Factor exceeds 8. For plots in panels B and D, white circles indicate means, horizontal lines within boxes indicate medians, pairs of connected dots indicate data from a single child, and boxes indicate interquartile ranges.

The interaction predicted children's ratings (*PM* = 0.37, 95% CI [0.00, 0.73], 4.53% in ROPE) (Fig. 3B). For both test trials (*PM* = 0.97, HPDI [0.72, 1.18]) and control trials (*PM* = 0.59, HPDI [0.31, 0.87]), children inferred that the character who had touched the protagonist would be more likely to know the trial content. However, this effect was stronger for the test trials (concerning the protagonist's unobservable goals and desires) than for the control trials (concerning the weather and the goal of an action that the protagonist undertook while observed). Preregistered analyses of children's forced-choice answers provided converging evidence: Children were more likely to say that the character who had touched the protagonist would know the content in the test trials than in the weather control trial (*PM* = 1.11, 95% CI [0.43, 1.82], 0% in ROPE) (Fig. 3C).

We next conducted exploratory analyses to understand whether results differed by control trial: two mixed-effects models, like the main model here, except that we only compared the test trials to the data from one of the control trials. The interaction predicted children's ratings for the first control trial (*PM* = 0.66, 95% CI [0.22, 1.09], 0% in ROPE) but not the second one (*PM* = 0.04, 95% CI [-0.42, 0.51], 34.97% in ROPE) (Fig. 3D). When running the model with the second control trial, but not the first, there was a main effect of trial type (*PM* = 0.87, 95% CI [0.64, 1.12], 0% in ROPE). Children thought that both characters would be more likely to know the protagonist's goal in the second control trial, relative to the test trials, perhaps because they had observed the protagonist act on their goal.

## Discussion

After seeing that one character had touched a protagonist and another had not, children inferred that the character who had touched the protagonist was closer to the protagonist, and children inferred that that character would be more likely to know the protagonist's goals and desires. Even when both characters had observed the protagonist act on their goal, children inferred that the character who had touched the protagonist would be more likely to know the protagonist's goal. Children also inferred that observing the protagonist's actions would make both characters more likely to know the protagonist's goal, and children did not infer that the character who had touched would be knowledgeable about states of the world that were irrelevant to the protagonist.

These findings suggest that children have an intuition that close social partners accurately represent each other's minds. If children have an intuitive theory of relationships, then they should also make the reverse inference: that if people are accurate about each other's minds, they are likely to be close social partners. We tested this prediction in Experiment 2.

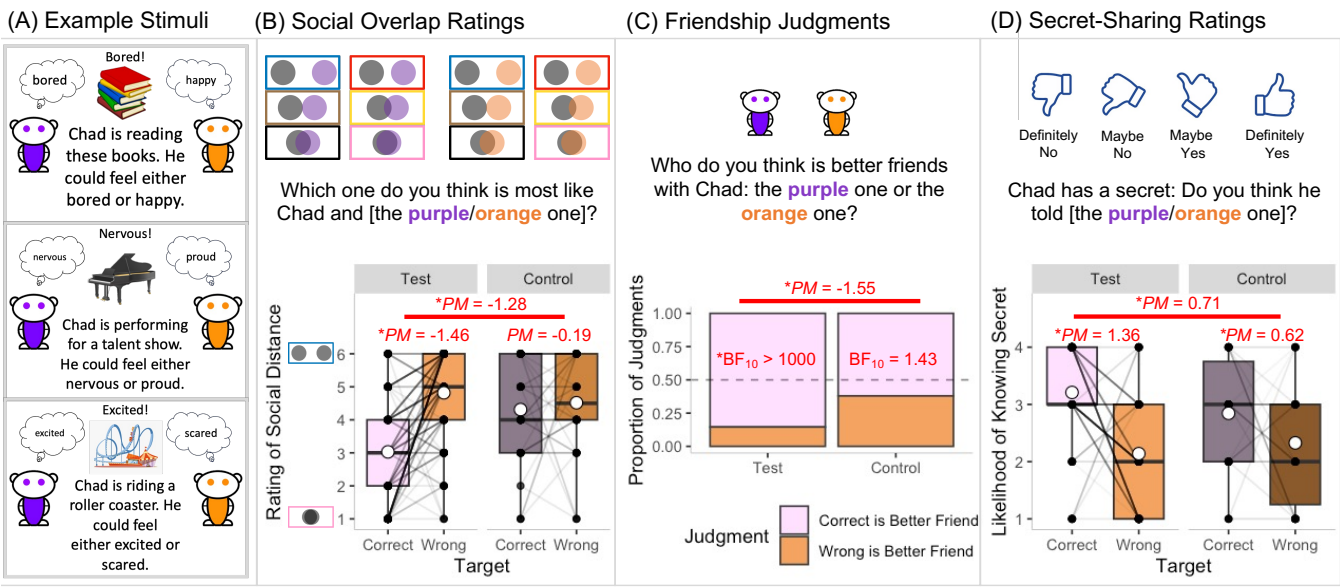


Figure 4: Example stimuli (A), as well as children's social overlap ratings (B), friendship judgments (C), and secret-sharing ratings (D) in Experiment 2. Across panels B-D, purple indicates responses concerning the character who was correct, and orange indicates responses concerning the character who was wrong. *PM* indicates posterior medians, $BF_{10}$ indicates the Bayes Factor, and asterisks indicate that 0 is not in the 95% credible interval or that the Bayes Factor exceeds 8. For plots in panels B and D, white circles indicate means, horizontal lines within boxes indicate medians, pairs of connected dots indicate data from a single child in a single trial, and boxes indicate interquartile ranges.

## Experiment 2

In Experiment 2, we presented children with characters who were either correct or wrong about a protagonist's emotional states, and we asked children about the characters' relationships. If children think people in closer relationships understand each other's minds, then they should rate the character who is correct as being closer to the protagonist.

**Participants** Fifty-eight 7- to 9-year-old children (mean age = 8.62 years, range = 7.01 to 9.99 years; 30 girls and 28 boys) were tested online. To determine a target sample size, we performed power simulations on pilot data ($n$ = 13). Because two of the 58 participants repeatedly failed an attention check for one trial, we did not include the data from that trial, and we scheduled two additional participants.

**Procedure** There was a warmup phase, followed by a test phase. In the warmup, the experimenter presented children with the social overlap scale (Fig. 1A) of Experiment 1, but with different colors and circles instead of pentagons.

In the test phase, each participant saw three test trials and one control trial. Each trial involved a different protagonist and two other characters who were distinguished by color (orange vs. purple). For each test trial, there were three vignettes involving a protagonist who engaged in an activity (e.g., going on a rollercoaster, meeting a dog) and could feel one of two ways (e.g., excited or scared) (Fig. 4A). Then, one character guessed that the protagonist felt one way (e.g., excited), while the other character guessed that the protagonist felt differently (e.g., scared). The experimenter then revealed how the protagonist actually felt and asked participants to confirm which character was correct (an attention check). Within each test trial, the same character was always correct about the protagonist's emotional states.

The control trial addressed the possibility that participants focus on correctness more generally and not specifically for mental states; it involved a subject irrelevant to a protagonist's emotional states. There were three vignettes of characters identifying fruits, with one character being consistently correct. As an attention check, the experimenter asked participants to confirm which character was correct.

Following the three vignettes for each trial, the experimenter asked the participants questions about each character's relationship with the protagonist. For the control trial, which had no protagonist in the vignettes, the experimenter introduced a protagonist (i.e., "They met a girl named Lisa"). Participants indicated on the social overlap scale which circles best represented the relationship between the protagonist and each character. Finally, the experimenter asked children about the protagonist's friendships and secret-sharing, as in Experiment 1.

**Counterbalancing** We counterbalanced the side of the purple character (left or right), the side of the character who was correct, and the order in which participants were shown the control trial (first, second, third, or fourth). There were 16 versions of the stimuli, and participants were randomly assigned to one of the versions.

## Results

**Social Overlap** We first ran the same model as in Experiment 1. As in Experiment 1, the target predicted the overlap rating (Fig. 1C). The children rated (i) a mother and baby (median = 1, IQR [1, 3]) as closer than two friends (median = 3, IQR [3, 4]) are (*PM* = -1.06, 95% credible interval (CI) [-1.47, -0.64], 0% in ROPE); and (ii) two friends as closer than two strangers (median = 6, IQR [6, 6]) are (*PM* = 2.80, 95% CI [2.20, 3.47], 0% in ROPE).

Given children's use of the scale, we examined whether accuracy in emotion reasoning led children to infer that people are closer on this scale. We conducted a preregistered model like that of Experiment 1, but with different fixed effects: the target (the correct vs. incorrect character), and the interaction between the two. The interaction predicted the overlap rating (*PM* = -1.28, 95% CI [-1.74, -0.81], 0% in ROPE) (Fig. 4B). We conducted posthoc pairwise tests to examine the effect of target within each question type. We found that children rated the character who was correct as being closer to the protagonist in the test trials concerning the protagonist's emotional states (*PM* = -1.46, highest posterior density interval (HPDI) [-1.70, -1.20]), but not in the control trial concerning factual knowledge (*PM* = -0.19, HPDI [-0.55, 0.21]).

**Friendship** We next examined children's judgments of friendship. In a preregistered analysis, we conducted a Bayesian logistic mixed-effects model, appropriate for a binary outcome variable, with default priors. The dependent variable was whether participants chose the character who was correct, and the fixed effect was the question type (test vs. control). We included participant ID as a random effect.

The question type predicted responses (*PM* = -1.55, 95% CI [-2.37, -0.72], 0% in ROPE; Fig. 4C). We conducted an exploratory Bayesian *t*-test, with default priors, to determine whether the proportion of test trials in which children chose the correct character differed from 50%. Children identified the character who was correct as the protagonist's better friend (mean proportion = 0.87, $BF_{10} > 1000$). We also conducted an exploratory Bayesian binomial test, with default priors, to determine whether the number of children who chose the correct character differed from 50% in the singular control trial. In the control trial, 36/58 children chose the character who was correct over the character who was wrong (proportion = 0.62, $BF_{10} = 1.43$).

**Secret-Sharing** Finally, we examined children's inferences of secret-sharing. The preregistered model was like that of Experiment 1, but with different fixed effects: the question type (test vs. control), the target (the correct vs. incorrect character), and the interaction between the two.

The interaction predicted children's responses (*PM* = 0.71, 95% CI [0.28, 1.18], 0% in ROPE; Fig. 4D). For both the test (*PM* = 1.36, HPDI [1.10, 1.60]) and control trials (*PM* = 0.62, HPDI [0.23, 1.05]), children inferred that the protagonist was more likely to tell a secret to the character who was correct, but the effect was stronger in the test trials.

## Discussion

Across measures in the test trials, the children rated the characters who were correct about a protagonist's emotional states as being closer to the protagonist compared to the characters who were wrong. By contrast, for two of the measures (social overlap and friendship judgments), the children did not see correctness in the control trials as evidence of closeness; and for the remaining measure (secret-sharing), the effect was significant but weaker than that of the test trials. Thus, children infer that people who are correct about each other's mental states are likely to be in close relationships, and this effect cannot be explained by a person being generally accurate. Future research should examine whether accuracy about mental states is stronger evidence of closeness than accuracy about external features (e.g., outfits).

# General Discussion

In two experiments, we find that 7- to 9-year-old children (i) reason that people who are close will accurately represent each other's goal states and desires and (ii) infer social closeness when people accurately predict others' emotional states. Moreover, we find that children map social distance onto physical distance, and that children use affective touch to make inferences about social closeness. These experiments add to a growing body of evidence that children have an intuitive theory of social relationships. By seven years of age, children expect people in close relationships to better represent each other's minds.

Key questions remain about children's understanding of mental state reasoning within close relationships. First, what is the breadth of this understanding? We have presented children with characters who reason about each other's emotions, goals, and desires. Would children have similar intuitions about social closeness when presented with other kinds of mental states (e.g., belief and knowledge states)?

Second, why do children think that people in close relationships better represent each other's minds? Future research could examine whether children think that people are more motivated to reason about the minds of close others, that people have more knowledge about close others, or both.

Third, when and how does this intuition develop? There is evidence that even infants and toddlers reason about social affiliation (e.g., Hamlin et al., 2007; Powell, 2022; Smith-Flores et al., 2024; Thomas et al., 2022). Future research may examine whether infants or younger children have the intuition that people in close relationships are better able to represent each other's minds. Future research should also examine the generalizability of these findings across cultures.

In sum, by 7 years of age, children reason flexibly about mental state attributions within close relationships. They can both (i) use people's social relationships to infer whether people will be correct about each other's mental states and (ii) use the accuracy of people's mental state attributions to infer social closeness. We look forward to research that continues investigating the breadth, the depth, and the origins of these intuitions about humans' social minds.

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