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Children's use of categories and mental states to predict social behavior

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Abstract

Integrating generic information about categories with knowledge of specific individuals is a critical component of successful inductive inferences. The present study tested whether children's approach to this task systematically shifts as they develop causal understandings of the mechanisms that shape individual action. 3- and 4-year-old children ($N = 65$) predicted harmful behaviors in scenarios that pitted category-based expectations—that individuals will harm members of opposing social categories—against expectations about agents' mental states—that individuals will harm people they are mad at. As children developed more advanced theories of mind, they became more likely to predict the agent's behavior based on individual mental states instead of category memberships. Thus, as children develop causal understandings of the mechanisms that shape individual behavior, they are more likely to override generic category information to base inferences on the relevant features of specific individuals.

Keywords: social categorization, theory of mind, causal mechanisms, social cognition

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Anticipating future social behaviors is a fundamental task of human social cognition. Integrating information about categories and individuals is an inherent challenge in accomplishing this task. For example, to decide what to get a young girl for her birthday, one must weigh stereotypes about girls (e.g., that they like dolls) against knowledge of her as an individual (e.g., that she often plays with trucks). The present study examines the possibility that how we accomplish this task—of integrating individual-level and category-level information to predict future events—systematically shifts across development.

Young children privilege category information over individual information across a range of social-cognitive tasks. For example, preschool-age children show better memory for information about social categories (e.g., that boys are good at puzzles) than comparable information about individuals (e.g., that a particular boy is good at a puzzle; Cimpian & Erickson, 2012). In addition, children show preferences and make inferences based on social categories in infancy (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Hamlin, Mahajan, Liberman, & Wynn, 2013; Liberman, Kinzler, & Woodward, 2014; Powell & Spelke, 2013; Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002) and do so quite robustly by the preschool years (Chalik & Rhodes, 2014; Diesendruck & haLevi, 2006; Gelman, Collman, & Maccoby, 1986; Kinzler, Shutts, DeJesus, & Spelke, 2009; Rhodes, 2012; Rhodes & Chalik, 2013; Shutts, Pemberton Roben, & Spelke, 2013). In contrast, children do not base inferences on individual-level features, such as past actions or personality traits, until middle childhood (e.g., predicting that someone who liked snow in the past would like snow in the future; Kalish, 2002; Lawson & Kalish, 2006; Rhodes & Gelman, 2008; Rholes & Ruble, 1984). A conceptual bias towards category knowledge may be particularly useful during early childhood when children need to rapidly

acquire vast amounts of information, as categories allow children to simplify their environment and enable efficient learning (Gelman, 2003; Cimpian & Erickson, 2012). But as they grow older, children acquire more experience with within-category variation, and perhaps thus become increasingly capable of integrating individual-level information into their generic knowledge.

Children's growing understanding of the causal mechanisms that underlie social behaviors may contribute to this developmental pattern. By preschool, children view certain social categories as causally constraining individual behavior (e.g., they explain that a girl will want to sew buttons *because* she was born a girl; Taylor, Rhodes, & Gelman, 2009). In contrast, children's understanding of the types of causal mechanisms that explain individual variation (instead of category-based similarities) appears to take longer to develop. For example, it is not until middle childhood that children understand the causal role of enduring traits in producing desires and behavior (e.g., explaining that a person will pick a red toy over a blue toy *because* they have a stable preference for that toy; Kalish, 2002; Rhodes & Gelman, 2008; Wellman & Woolley, 1990; Yuill, 1993; Yuill & Pearson, 1998).

Although this shift towards incorporating individual-level information across development is consistent with a range of previous empirical findings, it is not without debate. For example, in examining children's non-social categories, Sloutsky and colleagues (2004, 2007, 2010) have argued for the opposite pattern of development, claiming that younger children's inferences are based on individual features and do not involve abstract category knowledge until at least age 7. Similarly, with regard to social categories such as gender and race, some have argued that children's initial categories are based primarily on external characteristics and do not involve deeper conceptual knowledge until at least middle childhood (Aboud & Ruble, 1987; Doyle, Beaudet, & Aboud, 1988; Quintana, 1998; Rhoads, Newman, &

Ruble, 1990; Ruble, Alvarez, Bachman, Cameron, Fuligni, Coll, & Rhee, 2004; Ruble & Martin, 1998). Thus, there remains a great deal of debate around the roles of individual-level features and category-based knowledge in induction across development.

Very few previous studies have directly examined how children balance category-and individual-level information; rather, most prior work has examined either social category-based induction or inferences based on individual information (e.g., traits) separately (Cain, Heyman, & Walker, 1997; Diesendruck & haLevi, 2006; Gelman et al., 1986; Heyman & Gelman, 1999; Rhodes, 2013; Rhodes & Gelman, 2008; Shutts, Pemberton Roben, & Spelke, 2013; Waxman, 2010; Wellman, Cross, & Watson, 2001). The few prior studies that have directly compared children's use of categorical and individual knowledge have focused on the familiar social category of gender. For example, Berndt and Heller (1986) found that preschool-age children relied on gender categories to predict a child's behavior (e.g., that a girl would prefer to bake brownies than go fishing), even in the face of contrasting information about the individual (e.g., that this particular girl previously chose to play outside instead of with dolls; see also Biernat, 1991; Taylor, 1996; Taylor et al., 2009). Because children are exposed to gender stereotypes in their everyday lives, however, the amount of category information accessible to children in these studies was far greater than the amount of provided individual-level information, which could have contributed to this pattern.

The present work uses a novel groups paradigm, so that children do not approach the task with specific category-based stereotypes that could bias them away from individual-level information. In this context, we present children with inference problems that pit generic category-based expectations against conflicting individual-level information, and test whether there is a developmental shift towards basing these inferences on the individual-level

information. We also test whether children's growing understanding of relevant causal mechanisms in the social domain accounts for this developmental change. To do so, it was necessary to focus on a particular type of prediction and developmental time period where the development of children's causal understanding has been well documented. Thus, we focused on the development of theory of mind in the preschool years. Rudimentary understandings of mental states appear in infancy (Onishi & Baillargeon, 2005; Woodward, 1998). Yet, during the preschool years, children undergo dramatic changes in their explicit understandings of how mental states shape behavior. These changes can be precisely measured by assessing children's performance on a theory of mind scale, which documents children's progression through a series of conceptual insights: (1) that people hold and act on their own unique desires, (2) that people hold and act on their own unique beliefs, (3) that people will hold relevant knowledge only if they have had the required perceptual access to the information, and (4) that people can hold and act on beliefs that are false (Wellman & Liu, 2004).

The present study asked children to predict an agent's behavior (i.e., to whom an agent would direct a harmful action) based on either the agent's emotional state (i.e., knowledge that the agent is mad at one possible recipient, but not at the other) or the agent's social category membership (i.e., knowledge that the agent shares category membership with one possible recipient, and not the other). By age three, children have robust expectations that people are more likely to harm members of contrasting social categories instead of members of their own (Chalik & Rhodes, 2014; Rhodes, 2012; Rhodes & Chalik, 2013). In prior work, when three- and four-year-old children were introduced to novel social groups—labeled “Flurps” and “Zazzes”—they predicted that a Flurp would harm a Zazz instead of another Flurp on over 70% of trials (Rhodes,

2012). Thus, if children in the present study were given only category information, they should have inferred that the agents would harm members of the other group instead of their own.

The present study, however, did not ask children to predict behavior based on social category membership alone; instead, we pitted this category information against contrasting information about the agent's emotions. In particular, children were told that the agent was mad at the member of her own group, not the member the other group. By early preschool, children begin to understand the relation between individual emotional states and behavior (e.g., predicting that individuals will change their behavior because they are worried about the reoccurrence of a negative past event; Bamford & Lagattuta, 2010; Banerjee & Yuill, 1999; Lagattuta, 2007). Thus, if given only information about emotions (e.g., that an individual child is angry at one possible recipient, and not another) we would expect children to use the mental state information to predict behavior (e.g., to predict that the agent will harm the person that she is mad at).

Our key question involved how children reconcile these two types of information when they are pitted against each other. If told that an agent is angry with a member of her own group, will children predict her behavior based on group membership (and thus predict that she will harm a member of the other group, even though she is not angry at that person) or based on her mental state (and thus predict that she will harm the member of her own group, even though this conflicts with category-based expectations)? Here we predicted that children would be able to override category-based information to the extent that they understand the causal mechanisms that link mental states to individual action--in other words, their ability to do so should depend on their level of theory of mind.

Methods

Participants

Participants included 33 3-year-olds (M age = 3.51 years, range = 3.11-3.97, 23 female) and 32 4-year-olds (M age = 4.44, years range = 4.03-4.97, 21 female), recruited at the Children's Museum of Manhattan. Participants were 46.2% White, 6.2% African American, 4.6% Asian, 12.3% Hispanic, 4.6% Multi-ethnic, and 26.2% Unreported. An additional 28 children were tested but excluded: 5 because they did not finish the study, 8 because they failed to pay attention during the test session, 11 because of experimenter error, 2 because of parental interference, and 2 because of developmental disabilities¹.

Procedure

Group vs. Mental State condition. In the focal condition, referred to as the “Group vs. Mental State” condition ($N = 32$, 16 3-year-olds), children were asked to make predictions based on contrasting category and individual information. In this condition, children were introduced to novel social groups, which were marked by shirt color and category label, as presented in hand-drawn images (e.g., “Here is the red group. They are called the Flurps. Here is the blue group. They are called the Zazzes.”). The groups were labeled by the experimenter and described as

¹ Because this research took place at a children's museum, occasional distractions from the environment led to the need to exclude more participants than is often necessary with this age group. To make these decisions, a research assistant coded videotapes of all testing sessions for children's level of attention, distractions in the testing environment, and experimenter errors. Exclusion decisions were made based on these codes prior to data analysis. To confirm that these exclusions did not systematically alter our findings, we reran analyses with all children included. These analyses revealed patterns identical to those found in our main analyses.

participating in within-group collaborative activities (e.g., “The red Flurps are building a tower together.”). We introduced the groups in this manner because young children more easily make group-based inferences when there is some functional relationship between group members (Rhodes, 2012). To prevent this introductory material from biasing children to consider categories as the only source of relevant information, we also provided introductory material that referenced the individual agents’ mental states. In particular, participants were told about four individual children acting upon their desires (e.g., “This is a Flurp. He wants a cookie, so he is going to eat a cookie instead of a banana.”). In this manner, both the category memberships and the individual mental states of the agents were made salient to the participants prior to the test questions. Whether children received the introductory materials about the categories or the individual mental states first was counter-balanced across participants.

Next, children were asked four test questions about how individual agents would behave, which pitted category-level information against individual-level information. For each question, participants were presented with an agent, another child from the agent’s category, and one child from the other category. They were then told about the agent’s mental state—that he was angry only at the child from his own category (e.g., “The Flurp is really mad at this other Flurp. The Flurp is not mad at this Zazz.”). After completing a memory check question (e.g., “Can you point to who the Flurp is mad at? Can you point to who the Flurp is not mad at?”), children were then asked to predict whom the agent would direct a harmful action toward (e.g., “The Flurp hit somebody. Who did the Flurp hit? Did the Flurp hit the other Flurp or did the Flurp hit the

Zazz?”). The category membership of the agent and the lateral location of the answer choices were counterbalanced across participants².

Mental State Only condition. Because few prior studies have directly tested whether children of this age can predict behavior based on information about agents’ emotional states, we also included a “Mental State Only” condition ($N = 33$, 17 3-year-olds) to confirm that children in our sample would use emotional state information to predict our target behaviors in the absence of contrasting categorical information. Children were designated to either the Group vs. Mental State condition or the Mental State Only condition by random assignment. The Mental State Only condition was identical to the Group vs. Mental State condition, except that children were given no information about the category membership of the characters—instead, all of the

² Participants were also asked four test questions that regarded the physical state of the children, in counterbalanced order with the mental state questions. These questions were identical to the mental state questions, with the exception that instead of being angry at one of the other children, the agent had physical access only to one of the other children (e.g., “Max saw Jordan at school today. Max did not see Chris at school. Chris did not come to school today.”). Although these items were intended to be straightforward (children should have predicted that the agent would harm the recipient who was present in school), in all conditions, children’s responses did not differ from chance. Thus, it appears that children did not understand from the wording of these items that a child staying home from school would mean that the agent could not have interacted with him. Therefore, we did not analyze these items further. There were no main or interactive effects of whether children received these physical access items before or after the test questions of interest ($ps > .12$).

characters were wearing different-colored shirts and introduced with proper names. Children received neither the group nor individual introduction in this condition. The test questions were identical to those in the Group vs. Mental State condition, with the exception that proper names were used to refer to the agents and possible recipients (e.g., “Bobby is really mad at George. Bobby is not mad at John.”). In both conditions, children received a score of 1 each time they used individual-level information. Descriptive statistics are given as the proportions of trials on which children based inferences on individual-level information, so that scores closer to one represented relying more heavily on individual-level information, and scores closer to zero represented relying more heavily on category-level information (or in the Mental State Only condition, no relevant information).

Theory of mind tasks. Following the test questions in both conditions, children completed a scale of four theory of mind tasks (scripts are provided in Wellman & Liu, 2004). These tasks assessed: (1) Diverse Beliefs (people can have different beliefs; children predict whether someone else will act on her own beliefs, which contradict their own), (2) Knowledge Access (a person will not have knowledge if he has not had access to the relevant information; children predict whether someone will know the contents of a nondescript box), and (3) False Belief (someone can believe something that is false; children predict whether someone else will think that a box contains its true contents or the contents suggested by its appearance). Children completed two false belief tasks: Other False Belief, as described by Wellman and Liu (2004), and an additional task in which they made judgments about their own previous false beliefs (as opposed to those of a third party—Self False Belief). The order of tasks was as follows: Self False Belief, Diverse Beliefs, Knowledge Access, and Other False Belief. Children’s responses

were summed (1 = correct) so that scores closer to four represented more advanced theory of mind abilities.

Results

ToM scores did not differ between the Mental State Only ($M = 1.59$, $SE = .21$) and Group vs. Mental State ($M = 1.88$, $SE = .21$) conditions, $t(62) = -.938$, $p = .35$. We analyzed children's responses to the test questions using binomial logistic regression models, with condition as a fixed factor and theory of mind (ToM) score and age as continuous factors³, and tested for main effects of age, ToM score, and condition, and for interactions between age and condition, and condition and ToM score. We found a significant interaction between condition and ToM score, $\chi^2(1) = 6.87$, $p < .01$ (see Figure 1). There were no main or interactive effects of age. Testing the effect of ToM score separately in each condition revealed that ToM score predicted children's use of mental state information in the Group vs. Mental State condition, $\chi^2(1) = 6.90$, $p < .01$, but not in the Mental State Only condition, $\chi^2(1) = 1.08$, $p = .30$.

We followed up our main analyses using a median split to divide children into a low ToM level (passed 0-1 ToM tasks, $n = 34$) and a high ToM level (passed 2-4 ToM scores, $n = 30$), and tested for main effects of ToM level, condition, and age, and interactions between ToM level and

³ Past work using the ToM scale suggests that children come to pass these tasks according to a consistent developmental pattern, first passing diverse beliefs tasks, then knowledge access tasks, then false belief tasks (Wellman & Liu, 2004), and has often excluded children from analyses if they did not conform to this pattern (e.g., if they failed the diverse beliefs task but passed the knowledge access task). We reran our analyses using this more conservative exclusion criteria and found the same pattern as reported above.

condition, and age and condition. This analysis confirmed that in the Group vs. Mental State condition, children at the high ToM level used the mental state information ($M = .73$, $SE = .06$) more than children at the low ToM level ($M = .54$, $SE = .06$), $p = .03$, $OR = 2.29$, $CI = 1.07, 4.90$, whereas in the Mental State Only condition, use of mental state information did not vary by level of ToM (low ToM: $M = .73$, $SE = .05$; high ToM: $M = .67$, $SE = .06$). Additionally, low ToM children used mental state information more in the Mental State Only condition than in the Group vs. Mental State condition ($p = .02$, $OR = 2.29$, $CI = 1.13, 4.68$), whereas high ToM children performed equally across conditions. The interaction between condition and ToM level was reliable, $\chi^2(1) = 3.84$, $p = .05$, with no main or interactive effects of age. Comparisons to chance responding (.50) revealed that children in the Mental State Only condition used mental state information more often than expected by chance at both low ($t(17) = 3.19$, $p = .005$) and high ($t(13) = 2.35$, $p < .05$) ToM, as did children in the Group vs. Mental State condition with high ToM ($t(15) = 2.33$, $p < .05$); in the Group vs. Mental State condition, the responses of children with low ToM did not differ from chance ($t(15) = .38$, $p = .71$). Thus, if only information about mental states was available, children were able to use it to make predictions, but if this information conflicted with category-based expectations, children only used it to the extent that they possessed theory of mind.

To examine more precisely how children's responses related to the conceptual development of theory of mind, we also tested whether children's performance varied by each step on the theory of mind scale. Each analysis tested for main effects of children's score on the theory of mind task of interest, condition, and age, as well as interactions between ToM score and condition, and age and condition. There were no main or interactive effects of diverse beliefs scores, $ps > .6$. For knowledge access (see Figure 2a), in the Group vs. Mental State condition,

children who passed the knowledge access task ($n = 11$, $M = .88$, $SE = .05$) used emotional states to predict behavior more than children who failed the task ($n = 21$, $M = .50$, $SE = .06$; $p < .001$), whereas children's use of emotional states did not vary by knowledge access in the Mental State Only condition (passed: $n = 12$, $M = .65$, $SE = .07$; failed: $n = 21$, $M = .72$, $SE = .05$); the knowledge access by condition interaction was reliable, $\chi^2(1) = 10.40$, $p = .001$. Similarly, for false beliefs (see Figure 2b), in the Group vs. Mental State condition, children who passed the false belief task ($n = 8$, $M = .80$, $SE = .07$) used emotional states to predict behavior more than children who failed the task ($n = 24$, $M = .58$, $SE = .05$; $p = .08$), whereas children's use of emotional states did not vary by false belief understanding in the Mental State Only condition (passed: $n = 6$, $M = .64$, $SE = .11$; failed: $n = 26$, $M = .72$, $SE = .05$); the false belief by condition interaction was reliable, $\chi^2(1) = 3.96$, $p < .05$ (for these analyses, we only used children's responses to the Other False Belief task described by Wellman and Liu, 2004, because this task is part of the theory of mind scale and was designed to have similar processing demands as the diverse beliefs and knowledge access tasks). Again, in all of these analyses, there were no main or interactive effects of age, $ps > .3$.

Although we found no effects of age (as a continuous variable) in any analyses, we reran our main analysis treating age categorically (3-year-olds, 4-year-olds) to investigate whether 3- and 4-year-olds performed differently at the group level. This analysis again revealed an interaction between condition and ToM score, $\chi^2(1) = 14.57$, $p < .01$, and also revealed a main effect of age, by which 4-year-olds ($M = .81$, $SE = .04$) used mental state information more than 3-year-olds ($M = .56$, $SE = .06$), $\chi^2(1) = 10.37$, $p = .001$. As in the main analysis, however, the effect of age did not interact with the effect of condition. Thus, although children more reliably used mental state information to predict behavior with age, their tendency to do so particularly in

the face of contrasting category information was predicted by their level of theory of mind, not by age.

Discussion

In the present study, theory of mind reliably predicted 3- and 4-year-old children's tendency to use individual-level information over category-level information to predict behavior. When children only had information about the agents' mental states (in the Mental State Only condition), they based their inferences on this information regardless of their theory of mind abilities. When this information conflicted with category information (in the Group vs. Mental State condition), however, children relied on the mental state information to the extent that they passed theory of mind tasks. Thus, there is consistent change across development in how children weigh individual-level and category-level information against one another to predict social behavior. Further, theory of mind is a cognitive mechanism by which this change takes place—as children learn that mental states are causally linked to behavior, they rely more heavily on mental states to make inferences, even overriding conflicting generic knowledge.

Prior work has shown that when children are given information only about a character's social category, they reliably use this information to make predictions (Chalik & Rhodes, 2014; Diesendruck & haLevi, 2006; Gelman et al., 1986; Kinzler et al., 2009; Rhodes, 2012; Rhodes & Chalik, 2013; Shutts et al., 2013). Although the present study did not include a condition in which children were asked to predict behaviors based on category information alone, Rhodes (2012) presented categories identical to those used here and found that 3- and 4-year-olds reliably used them to predict these target actions (e.g., predicting that a “Flurp” would hit a “Zazz” over 70% of the time; also Chalik & Rhodes, 2014). Based on this prior work and the present study, we suggest that children of these ages have a firm understanding that categories

constrain these behaviors (e.g., that individuals will harm members of contrasting social groups), as well as a nascent understanding of the role of emotional states in shaping behavior. However, children's understanding of emotional states can only override their category-based expectations to the extent that they have developed theory of mind. Thus, at lower levels of theory of mind, children cannot reliably use mental state information to override category-based expectations, resulting in chance-level performance. The difference between the Mental State Only and Mental State vs. Group condition for these children shows that categories are interfering with these children's abilities to use mental state information to predict behavior.

This study is the first to clearly document a developmental shift in how children integrate category-level and individual-level information to predict future events. In doing so, this study highlights one developmental limitation of early induction. Younger children's over-reliance on generic category knowledge at the expense of individual-level information—though useful for efficient learning—can have some problematic consequences. For example, if children have a generic expectation that dogs are friendly, they might neglect information about a particular dog's behavior, and thus not realize the need to avoid an aggressive pit bull (Rhodes & Brickman, 2010). In the social domain, neglecting within-category variation and assuming that social category members are fundamentally similar to one another contributes to prejudice and stereotyping (Haslam, Rothschild, & Ernst, 2002; Leslie, *in press*; Prentice & Miller, 2007; Rhodes, Leslie, & Tworek, 2012). Thus, understanding the process by which children learn to incorporate individual-level information into their inferences yields important insights into how to promote cognitive and social development.

The present study reveals one mechanism that contributes to the conceptual changes that enable children to integrate individual-level and category-level information—their developing

understanding of the causal mechanisms that shape individual action. A puzzling finding from prior work in developmental and social psychology is that exposing children and adults to examples of within-category variation is often ineffective at reducing category-based expectations or stereotyping (e.g., showing children examples of female doctors does not reduce their endorsement of the stereotype that doctors are male; Liben & Signorella, 1987). The present study suggests that a different approach—helping children to understand the underlying causal mechanisms that contribute to individual variation—may more effectively help children incorporate within-category variation into their inferences. In future work, it would be useful to adopt a fully experimental approach to this issue. For example, if we were to experimentally manipulate children’s mental state understanding (as studies using microgenetic methods have done; Rhodes & Wellman, 2013), we would expect to see the same trajectory across conditions that is reported here, by which children who have been induced with a better understanding of theory of mind should be more likely to use individual mental states in their predictions, even when that information conflicts with category-level information. Such work could inform efforts to establish new methods for promoting conceptual change.

This work also highlights an important implication of the development of an explicit theory of mind in the preschool years. The present findings show that this development affords children abilities beyond those measured by the theory of mind scale—thinking about desires, perceptual access, and beliefs—to shape how children integrate information about mental states with generic category-based knowledge to predict social behavior. Thus, even though children have implicit theories of mind much earlier in development (Onishi & Baillargeon, 2005; Woodward, 1998), the development of an explicit theory of mind in the preschool years has important implications for the development of social cognition. The development of explicit

mental state understanding is correlated with children's popularity with peers (Peterson & Siegal, 2002; Slaughter, Dennis, & Pritchard, 2002) and positive peer interactions (Astington & Jenkins, 1995; Dunn, Cutting, & Demetriou, 2000; Peskin & Ardino, 2003); the present study suggests that one reason why the development of explicit ToM is linked to these skills could be that children with more advanced theories of mind are better able to incorporate information about individuals into their expectations about important social behaviors, and accordingly, can navigate social relationships more effectively.

Because the effect of condition was predicted by theory of mind, and not by age, it is unlikely that these findings stem from general age-related changes in children's abilities to integrate multiple sources of information. Yet, because theory of mind is correlated with other cognitive abilities, we cannot conclusively show that theory of mind is the *only* mechanism underlying the conceptual change reported here. For example, the development of theory of mind in the preschool years is correlated with the development of executive function—the more domain-general cognitive abilities that provide the basis for processes like self-regulation, planning, and inhibition (Benson, Sabbagh, Carlson, & Zelazo, 2013).

Yet, it is unlikely that the development of executive function fully accounts for the present findings. Although executive function correlates with the ability to pass false belief tasks (Benson & Sabbagh, 2010; Benson et al., 2013; Carlson & Moses, 2001; Carlson, Moses, & Hix, 1998; Davis & Pratt, 1995), the development of executive function does not fully account for developmental changes in false belief performance in the preschool years (Benson & Sabbagh, 2010; Moses, Carlson, & Sabbagh, 2005; Oh & Lewis, 2008; Ozonoff, Pennington, & Rogers, 1991; Ozonoff, Rogers, & Pennington, 1991; Pellicano, 2007; Sabbagh, Moses, & Shiverick, 2006; Sabbagh, Xu, Carlson, Moses, & Lee, 2006; Wellman et al., 2001). Further, performance

on false belief tasks has been found to predict other components of social development (e.g., the ability to keep a secret) even controlling for executive function (Peskin & Ardino, 2003) or other more general cognitive abilities (e.g., Astington, 2003; Astington & Jenkins, 1995; Peterson, Slaughter, & Paynter, 2007; Watson, Nixon, Wilson, & Capage, 1999).

More relevant to the present data, executive function has been found to correlate with each step of the theory of mind scale tested here—diverse beliefs, knowledge access, and false beliefs (Henning, Spinath, & Aschersleben, 2011; as would be expected, given that each of these tasks involves conflicting epistemic states and the tasks were designed to have similar processing demands). Thus, if the development of executive function fully accounted for the conceptual change found here, we should have found an increase in individual-based predictions corresponding with each step in the scale. Instead, we found effects only of the more advanced steps on the theory of mind scale—knowledge access and false beliefs—but not diverse beliefs. This pattern suggests that children’s ability to use mental states to predict behavior—in the face of contrasting category-based expectations—depends on a more robust understanding of how individual mental states arise, not only on executive function. Further, as executive function is correlated at least as strongly with age as with theory of mind abilities (Carlson & Moses, 2001; Carlson, Moses, & Breton, 2002; Jenkins & Astington, 1996), our current finding that age does not predict the effect of condition on the current task is inconsistent with the possibility that the present findings stem solely from developmental changes in executive function. It is thus unlikely that the development of executive function can fully account for the present results—yet, we cannot completely rule out this possibility, and future work should directly address this question.

The present data demonstrate how children's developing understanding of a specific type of causal mechanism—the role of mental states in constraining behavior—enables them to predict behavior based on individual emotions instead of on social categories. More generally, these data suggest that children's growing understanding of causal mechanisms will enable them to more effectively incorporate individual-level information into their inferences. These findings are relevant across a range of domains in which causal understandings develop during childhood—for example, when deciding whether to pet a dog, a child should come to realize that knowledge of an individual dog's past behavior (e.g., that a certain dog is known to bite) may be more causally related to that dog's future behavior than their generic knowledge about dogs (e.g., that they are generally friendly). Thus, children may learn to incorporate individual-level variation into their inferences at different times in different domains, as they develop understandings of relevant domain-specific causal mechanisms.

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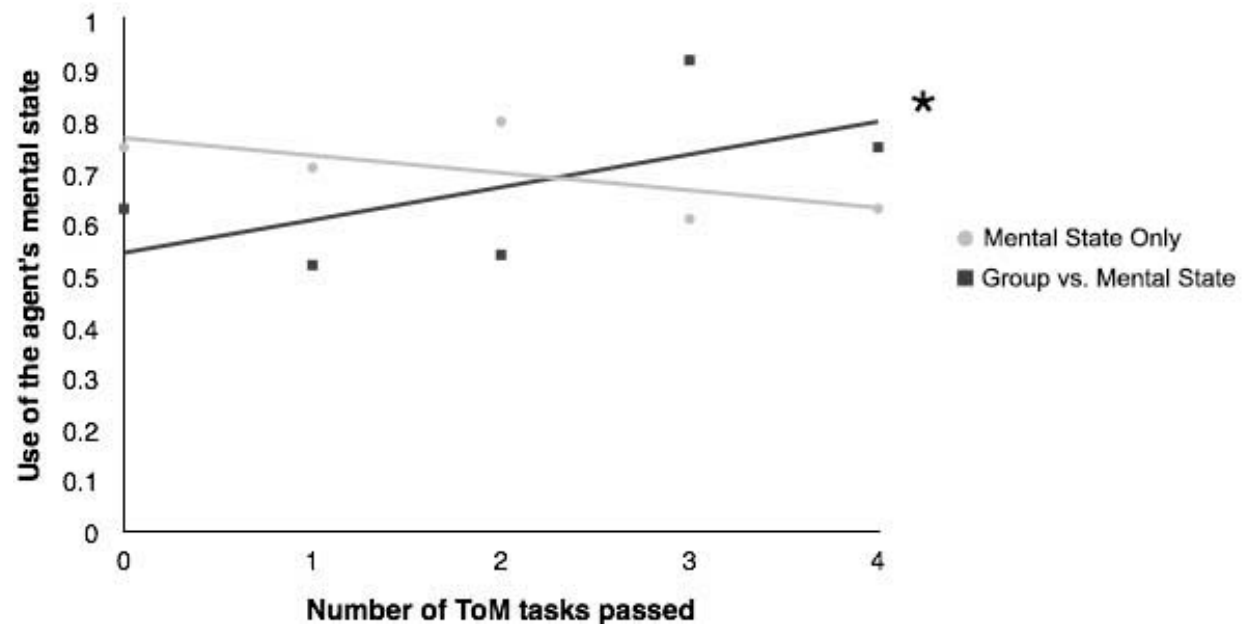
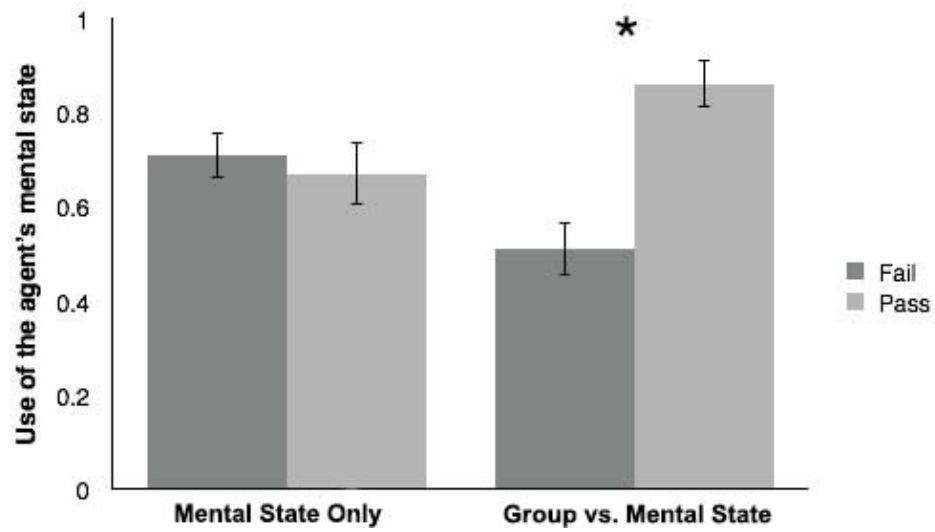


Figure 1. Regression lines for children's use of the agent's mental state to predict behavior in each condition. In the Mental State Only condition (light gray line), the relationship between children's use of mental state information and ToM score was not significant, whereas in the Group vs. Mental State condition (dark gray line), ToM score reliably predicted children's use of mental state information—as children's ToM score increased, the likelihood that they would use the agent's mental state increased.

(a)



(b)

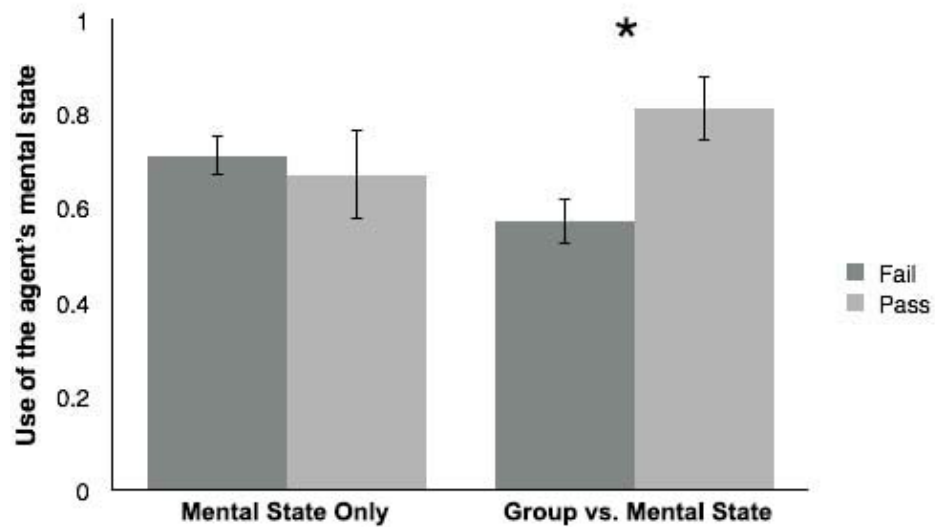


Figure 2. Children's use of the agent's mental state, by condition, for the (a) Knowledge Access and (b) Other False Belief tasks. Error bars represent standard error.