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Abstract

This study investigated the development of social mindfulness understanding in 4- to 6-year-old children and its relationship with theory of mind. The study measured social mindfulness understanding, theory of mind, prosociality, and executive function in 100 children aged 4–6 years. The results revealed that with increasing age, children showed a growing tendency to favor socially mindful characters in social evaluation and friend preference. Furthermore, this social mindfulness understanding ability demonstrated a significant positive correlation with the development of theory of mind, and this correlation remained robust after controlling for age, executive function, and prosociality. However, social mindfulness understanding was not correlated with prosociality. These findings suggest that theory of mind may play an important role in the development of social mindfulness understanding.

Full Text

The Relationship Between Preschoolers' Understanding of Social Mindfulness and Theory of Mind

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Abstract

This study investigated the development of 4- to 6-year-old children' s understanding of social mindfulness and its relationship with theory of mind. We measured social mindfulness understanding, theory of mind, prosociality, and executive function in 100 children aged 4-6. Results showed that with increasing age, children increasingly favored socially mindful characters in both social

evaluation and friend preference. This understanding of social mindfulness was significantly positively correlated with theory of mind development, and this correlation remained stable after controlling for age, executive function, and prosociality. However, social mindfulness understanding was not correlated with prosociality. These results suggest that theory of mind may play an important role in the development of social mindfulness understanding.

Keywords: social cognitive development, social mindfulness, theory of mind, preschool development, moral cognition

1 Introduction

We live in a highly socialized world with continuous interaction between people. "Burning oneself to illuminate others" is a traditional virtue in Chinese culture. People praise prosocial behaviors that serve others at the cost of one' s own interests. Even infants evaluate others based on their prosocial or antisocial behaviors (Burns & Sommerville, 2014; Hamlin et al., 2007; Van de Vondervoort & Hamlin, 2017). For instance, infants prefer those who help others complete goals over those who hinder them (Hamlin et al., 2007; Van de Vondervoort & Hamlin, 2017), and prefer those who share over those who are stingy (Burns & Sommerville, 2014).

Previous research on children' s own prosocial behaviors or their understanding of others' prosocial behaviors has primarily focused on actions such as helping or sharing (Bridgers et al., 2020; Chernyak & Kushnir, 2013; Dahl, 2015; Dunfield et al., 2011; Liszkowski et al., 2008; Svetlova et al., 2010; Van de Vondervoort & Hamlin, 2017; Warneken & Tomasello, 2006). These prosocial behaviors often require actors to sacrifice their own interests to benefit recipients—for example, sharing one' s own toys with others. However, kindness and care for others sometimes do not require self-sacrifice but can be achieved at low cost; a small gesture can convey goodwill toward others. In recent years, increasing research has begun to examine these more common but subtle prosocial behaviors. The concept of "social mindfulness" (Van Doesum et al., 2013) that this paper focuses on describes precisely such a low-cost prosocial behavior that expresses kindness to others. Because social mindfulness behaviors are very subtle, understanding such behaviors may not be easy for children, making it important to study children' s understanding of social mindfulness behaviors. Below, we first introduce social mindfulness and related concepts.

1.1 Social Mindfulness

Social mindfulness refers to a prosocial behavior in which individuals attentively, respectfully, and protectively consider others' needs and rights to choose (Van Doesum et al., 2013; Dou, Liu, et al., 2018; Zhao, Zhao et al., 2021). For example, at a buffet party, Xiao Ming and Xiao Hong are queuing for dessert. When Xiao Ming, who is ahead in line, takes dessert, only two strawberry cakes and one chocolate cake remain. Xiao Ming' s subsequent choice may affect

whether Xiao Hong still has a choice. If Xiao Ming takes a strawberry cake, Xiao Hong can then choose between a strawberry cake and a chocolate cake. In this case, Xiao Ming demonstrates social mindfulness because he satisfies his own need to eat cake while also considering Xiao Hong' s needs behind him, preserving her freedom to choose. Conversely, if Xiao Ming takes the only chocolate cake, Xiao Hong can only choose strawberry cake, and Xiao Ming does not demonstrate social mindfulness because he deprives Xiao Hong of choice.

In highly socialized environments, social mindfulness behaviors are important for both individuals and society as a whole. From an individual perspective, demonstrating social mindfulness can leave good impressions on others and facilitate interpersonal interaction and cooperation (Dou, Liu, et al., 2018; Van Lange & Van Doesum, 2015). From a societal perspective, social mindfulness behaviors help build good social relationships and harmonious social environments. Overall, social mindfulness is likely an important tool to help people "navigate" society (Van Doesum et al., 2013), and it aligns highly with the virtues of kindness, modesty, and courtesy advocated in traditional Chinese culture.

In recent years, "social mindfulness" has become a research hotspot in social and developmental psychology both in China and abroad (Dou, Liu, et al., 2018; Dou, Nie, et al., 2018; Dou et al., 2017; Tian et al., 2020). Research on adults'"social mindfulness" has found that when acting as actors, most adults demonstrate social mindfulness by leaving choices for others, and the frequency of this behavior is positively correlated with prosocial tendencies and empathy (Van Doesum et al., 2013). Additionally, when acting as third-party observers, adults evaluate behaviors that leave choices for others (i.e., socially mindful behaviors) more positively than behaviors that do not (Van Doesum et al., 2013), and are more inclined to cooperate with individuals who demonstrate socially mindful behaviors (Dou, Liu, et al., 2018). Recently, child development researchers have begun to investigate children' s understanding and evaluation of socially mindful behaviors when they are third-party observers. These studies have focused primarily on whether children can distinguish between socially mindful behaviors (i.e., leaving choices for others) and non-socially mindful behaviors (i.e., depriving others of choice), and whether they evaluate individuals who demonstrate socially mindful behaviors more positively (Zhao, Zhao et al., 2021). Zhao, Zhao et al. (2021) presented Chinese and American 4- to 6-year-old children with stories about kindergarten children queuing for snacks. During two snack times, the story character at the front of the line had to choose among two fruits of the same type and one unique fruit (e.g., two apples and one banana). During one snack time, the front character chose one of the two same-type fruits, leaving two different fruits for the character behind (i.e., demonstrating socially mindful behavior). During the other snack time, the front character chose the unique fruit, leaving two identical fruits (i.e., demonstrating non-socially mindful behavior). When asked to compare the two story characters, both Chinese and American 4-year-olds responded at chance level, while most Chinese and American 6-year-olds gave higher social evaluations to the person who left choices. That is, between ages 4 and 6, both Chinese and American children gradually

understand and can evaluate socially mindful behaviors.

Although these studies indicate that children' s understanding and evaluation of socially mindful behaviors develop importantly between ages 4 and 6, many questions remain unanswered. First, although research shows that 6-year-old Chinese and American children both significantly believe that the story character demonstrating socially mindful behavior is a better friend to the character behind, it remains unclear whether children' s social evaluations are limited to assessing relationships between story characters, or whether they also affect children' s own friend preferences—for example, whether children themselves also prefer to choose individuals who demonstrate socially mindful behaviors as their friends. Adult research indicates that people are more inclined to cooperate with those who demonstrate socially mindful behaviors (compared to those who do not) (Dou, Liu, et al., 2018). Based on these findings, this paper will investigate whether children' s own friend selection preferences are influenced by whether the other party demonstrates socially mindful behaviors.

More importantly, the developmental mechanism of children's social mindfulness understanding remains unclear. Why can children gradually distinguish between individuals who demonstrate socially mindful behaviors and those who do not, and evaluate the former more positively, between ages 4 and 6? This study aims to preliminarily explore the relationship between 4- to 6-year-old children' s social mindfulness understanding and theory of mind. Below, we elaborate in detail on why we hypothesize that an important relationship may exist between the two.

1.2 Social Mindfulness Understanding and Theory of Mind

Theory of mind (ToM) refers to the ability to understand others' mental states (desires, beliefs, emotions, etc.) and thereby predict their behaviors (Premack & Woodruff, 1978; Wellman, 2014), and constitutes an important component of children' s social cognitive development. Numerous studies have found that theory of mind develops rapidly during the preschool period, as children gradually understand that others' preferences and beliefs may differ from their own and from reality, and that emotions others display may differ from their internal feelings (Liu et al., 2008; Lu et al., 2008; Wellman, 2014; Wellman et al., 2006; Wu & Su, 2014).

Although no empirical research has yet examined the relationship between social mindfulness understanding and theory of mind, previous studies provide some theoretical support. Van Doesum et al. (2013), from the actor' s perspective, elaborated on the potential mechanisms required for a person to demonstrate socially mindful behavior itself from two aspects: skill and will. They argued that to demonstrate socially mindful behavior, an actor needs to, on the one hand, understand that their behavior may have potential impact on the other party, which is likely based on theory of mind or perspective-taking. On the other hand, they also need to have the willingness to demonstrate socially mind-

ful behavior toward others, which is likely based on prosocial orientation. This paper focuses on whether, from the third-party observer' s perspective, children' s understanding of socially mindful behaviors is related to theory of mind (especially understanding of others' preferences, desires, and intentions).

We believe that, in terms of the psychological mechanisms required to understand and evaluate socially mindful behaviors, the development of children' s theory of mind is likely the psychological foundation of social mindfulness understanding. Specifically, when evaluating socially mindful behaviors, children need to, on the one hand, understand the recipient' s (i.e., the person behind in line) preferences and desires. When the recipient' s preferences are unknown (as in the buffet example, where Xiao Ming does not know whether Xiao Hong prefers chocolate or strawberry cake), the actor' s socially mindful behavior of leaving two different options can maximize the realization of the recipient' s desires. That is, regardless of the recipient' s preferences, the actor' s socially mindful behavior can ensure that the recipient can autonomously choose their preferred item, thereby best satisfying their desires. This understanding of others' preferences and desires is an important part of theory of mind. On the other hand, children also need to infer the actor' s prosocial intentions from their behavior to make social evaluations. Specifically, children need to infer that the actor leaves different options because they have considered the recipient' s interests and want to preserve their right to choose. This involves reasoning about others' intentions, which is also an important part of theory of mind. Therefore, from these two perspectives, theory of mind may be the underlying psychological mechanism supporting the development of social mindfulness understanding.

Additionally, previous research provides some indirect evidence suggesting that children' s social mindfulness understanding may be correlated with their theory of mind development. First, the developmental age ranges of theory of mind and social mindfulness show some similarity. As mentioned above, children' s understanding of social mindfulness gradually matures between ages 4-6 (Zhao, Zhao et al., 2021). The preschool period is also a critical age for children' s theory of mind development (Wang et al., 2000). Therefore, in terms of developmental age ranges, children' s understanding of socially mindful behaviors is likely related to their theory of mind development. Second, research shows that children' s intention-based social evaluations are closely related to theory of mind. Children with higher theory of mind development can more flexibly consider intentions behind behaviors when evaluating others, rather than focusing solely on outcomes (Smetana et al., 2012). This suggests that children with better theory of mind development can make more flexible and complex social and moral evaluations. It should be noted that social mindfulness understanding essentially also belongs to a type of social and moral evaluation that requires consideration of behavioral intentions, and therefore may also be closely related to theory of mind development. Based on these arguments, we hypothesize that there may be a correlation between children' s social mindfulness understanding and theory of mind development.

1.3 Other Influential Variables: Prosocial Orientation and Executive Function

The main purpose of this paper is to explore whether a correlation exists between children' s social mindfulness understanding and theory of mind development, but other factors may simultaneously influence both social mindfulness understanding and theory of mind, such as prosocial orientation and executive function. As mentioned above, Van Doesum et al. (2013) believe that prosocial orientation may play an important role in socially mindful behavior, and adult research has found that the frequency of this behavior is positively correlated with prosocial orientation and empathy (Van Doesum et al., 2013). However, these adult studies focus primarily on socially mindful behavior itself, rather than understanding or evaluation of such behavior. Therefore, whether children' s understanding and evaluation of socially mindful behaviors is correlated with prosocial orientation remains unclear.

One possibility is that prosocial orientation may also play an important role at the level of understanding socially mindful behaviors. Numerous studies have found that children show prosocial behaviors and motivations even in infancy, such as actively sharing items with parents (Hay, 1979; Hay & Murray, 1982; Rheingold et al., 1976), and that prosocial behaviors further develop with age (Chernyak & Kushnir, 2013; Engelmann et al., 2013; Fehr et al., 2008; Moore, 2009). Children with stronger prosocial tendencies may more easily notice how individuals' behaviors affect others, and consequently have better understanding of socially mindful behaviors. Another possibility is that such prosocial willingness and inclination is not necessary for understanding itself. In fact, research shows there is a "cognition-behavior gap" between children' s prosocial behaviors and their cognition of prosocial behaviors (Blake et al., 2014). For example, children can distinguish between fair and unfair behaviors early on (Schmidt & Sommerville, 2011; Sloane et al., 2012) and evaluate fair behaviors more positively, but they often exhibit unfair or self-interested resource distribution in their actual behavior (Blake, 2018; Blake et al., 2014). Therefore, prosocial orientation may not be correlated with the cognitive-level development of social mindfulness understanding.

Additionally, research suggests that there may be a correlation between the development of children' s prosocial behaviors (e.g., sharing) and theory of mind development (Wu & Su, 2014). Therefore, in this study we will measure children' s prosocial orientation, which can on the one hand answer whether a correlation exists between social mindfulness understanding development and prosocial orientation, and on the other hand help control for prosocial orientation as a potential confounding variable, thereby addressing whether a unique correlation exists between social mindfulness understanding and theory of mind beyond prosocial orientation.

Furthermore, children' s executive functioning may also simultaneously influence the development of both social mindfulness understanding and theory of

mind. Numerous studies have shown correlations between children' s executive function and theory of mind development (Carlson & Moses, 2001; Sabbagh et al., 2006). Additionally, although there is no direct empirical evidence, children' s executive function (or general cognitive ability) is likely to affect their performance on social mindfulness understanding tasks. Therefore, this study will measure children' s executive function as a control for general cognitive ability, which can address whether a unique relationship exists between social mindfulness understanding and theory of mind beyond general cognitive ability.

1.3 The Present Study

In summary, this study will take 4- to 6-year-old children, who are at an important stage of social mindfulness understanding development (Zhao, Zhao et al., 2021), as participants to explore 4- to 6-year-old children' s social evaluations of characters demonstrating socially mindful or non-socially mindful behaviors, testing whether results are consistent with previous findings. It will also investigate whether socially mindful behaviors affect children' s own friend selection preferences—that is, whether children prefer to be friends with individuals who demonstrate socially mindful behaviors. More importantly, this paper will explore the relationship between social mindfulness understanding and theory of mind. Additionally, we measured children' s prosocial orientation and executive function as control variables. For measuring social mindfulness understanding, we adapted tasks from Zhao, Zhao et al. (2021). For measuring theory of mind, we adapted the unexpected contents task, unexpected location task, and hidden emotion task from Wellman et al. (2006). For measuring prosocial orientation, we combined children' s laboratory behavioral tests with parent and teacher reports: on one hand, we used an anonymous sharing task adapted from Brownell et al. (2009; 2013) to measure children' s sharing behavior, and on the other hand, we had parents and teachers evaluate children' s prosociality to more comprehensively measure the development of children' s prosocial orientation. For measuring executive function, we used the Day/Night Stroop task adapted from Gerstadt et al. (1994). These tasks have been widely used to measure children both domestically and internationally in previous research (Zhao, Wente et al., 2021; Wellman et al., 2006; Sabbagh et al., 2006).

2 Method

2.1 Participants

Based on previous studies with similar topics investigating children' s social mindfulness (Zhao, Zhao et al., 2021) and relationships between psychological measures (Zhao, Wente et al., 2021; Sabbagh et al., 2006), we predetermined our sample size to be 100. One hundred children aged 4-6 from three kindergartens in Shanghai participated in this study (M age = 5.53 years, SD = 0.46; 54 girls, 46 boys). Among them, 11 were 4-year-olds, 68 were 5-year-olds, and 21 were 6-year-olds†. The family background of participating children was similar to that in Zhao, Zhao et al. (2021). Most children came from middle-class

families, 94.7% of parents had bachelor's degrees or higher, and 64.5% of families had annual incomes between 200,000 and 500,000 RMB. All parents provided informed consent.

The methods, sample size, and main analyses of this paper were preregistered on the AsPredicted website (https://aspredicted.org/PHN_{NFZ}). Specific instructions and data are available on the OSF website (https://osf.io/9feum/?view_{only}=eb95eeafba1447faa49

2.2 Procedure

The experiment was conducted in a quiet room in the kindergarten. Children completed four tasks in fixed order: theory of mind task, sharing task, social mindfulness understanding task, and executive function task.

2.2.1 Theory of Mind Task This task was adapted from Wellman et al. (2006) and consisted of three subtasks.

(1) **Unexpected Contents Task**. The experimenter presented a band-aid box and asked the child what was inside (the child answered "band-aids"). The box was then opened to reveal a blueberry toy, which was placed back and the box restored. The experimenter asked: "What do you think is in the box now?" to ensure the child knew it contained a blueberry. Next, the experimenter introduced a new character, Pi Pi, who had never seen inside the box, and asked: "Pi Pi has never seen inside this box. What do you think Pi Pi thinks is in the box? Band-aids or a blueberry?" This question was scored 1 point for correct answer (i.e., "band-aids") and 0 for incorrect. Finally, a memory check question was asked: "Has Pi Pi seen inside the box?" (Correct answer: No). If the child answered the memory check incorrectly, the task was not scored (1% of children answered the memory check incorrectly).

(2) **Unexpected Location Task**. The experimenter showed two pictures: one with a cat hiding in bushes, and another of a garage. The experimenter then presented a story character, Lin Lin, and explained the situation: "Lin Lin' s cat is hiding in the bushes, but Lin Lin thinks the cat is in the garage. Now she is going to look for the cat." The child was asked: "Where do you think Lin Lin will look for the cat? Will she look in the bushes or in the garage?" This question was scored 1 point for correct answer (i.e., "garage") and 0 for incorrect. Finally, a memory check question was asked: "Where is the cat actually?" (Correct answer: Bushes). If the child answered the memory check incorrectly, the task was not scored (7% of children answered the memory check incorrectly).

(3) **Hidden Emotion Task**. The experimenter presented three faces with different expressions and asked: "Can you tell me which face is happy? Which is sad? Which is okay?" After ensuring the child accurately recognized these expressions, the experimenter told a story about a pony: "On

the pony' s birthday, friends gave him a boring book, but the pony actually hoped to receive a toy car. To be polite, the pony decided to hide his emotions." The experimenter then asked two memory check questions to ensure the child understood the story: "What gift did the pony hope to receive? What did he actually receive?" If memory check questions were answered incorrectly, the task was not scored (1% of children answered memory check incorrectly). The experimenter then asked two test questions: one about the pony' s inner feelings ("How does the pony actually feel inside? Does he feel happy, okay, or sad inside?") and one about the pony' s facial expression ("What does the pony' s face look like? Does he look happy, okay, or sad?"). If the child' s answer about inner feelings was more negative than their answer about facial expression (i.e., inner feeling sad while facial expression okay or happy; or inner feeling okay while facial expression happy), 1 point was scored; otherwise, 0 points.

Scores from the three theory of mind tasks were averaged to calculate the theory of mind task score (range 0-1).

2.2.2 Sharing Task This task was adapted from Brownell et al. (2009; 2013). The experimenter provided 2 envelopes and 5 stickers, informing the child that they could share stickers with another child who would play later. During distribution, the experimenter turned away to ensure the child' s sharing was anonymous. Before the child distributed stickers, the experimenter asked: "Which envelope is yours? Which is for the other child? Did anyone see how you distributed them?"to ensure the child understood the task and believed sharing was anonymous. We recorded the number of stickers the child shared with others (range 0-5).

2.2.3 Social Mindfulness Understanding Task This task was adapted from Zhao, Zhao et al. (2021). The experimenter showed the child a video about kindergarten fruit snack time. There were two snack times in the day. During snack time, children queued to choose fruit. During one snack time, Bei Bei was behind Huan Huan in line. When it was Huan Huan' s turn, there were two apples and one banana available. Huan Huan chose an apple, leaving one apple and one banana (i.e., demonstrating socially mindful behavior). During the other snack time, Bei Bei was behind Le Le in line. When it was Le Le' s turn, there was one apple and two bananas available. Le Le chose the apple, leaving two bananas (i.e., demonstrating non-socially mindful behavior). The experimenter first asked memory check questions: "What did Huan Huan choose during morning snack? What did she leave for Bei Bei? What did Le Le choose during afternoon snack? What did she leave for Bei Bei?" If the child answered incorrectly, the story was retold until the child answered correctly. The experimenter then asked two test questions: (1) Social evaluation question: "For Bei Bei, who is a better friend, Huan Huan or Le Le?" (2) Friend preference question: "Would you choose Huan Huan or Le Le as your friend?" After both test questions, the experimenter asked "why" to have children explain their

answers. Story examples are shown in Figure 1. The fruit combinations and character orders presented in this task were counterbalanced across participants, and the two test questions were also counterbalanced.

2.2.4 Executive Function This task was adapted from Gerstadt et al. (1994) Day/Night Stroop task. The experimenter showed pictures of the sun and moon and explained the game rules: "When you see the sun, say 'night'; when you see the moon, say 'day'." After practice where the participant answered correctly at least twice, the formal experiment began. This task consisted of 16 trials, and the experimenter recorded accuracy rates.

2.2.5 Parent and Teacher Ratings of Children' s Prosociality To more comprehensively measure children' s prosocial orientation, we also had parents and teachers complete questionnaires about children's prosociality. In the parent questionnaire, parents answered two questions: "Based on your observations, does your child demonstrate helping behaviors in daily life?" and "Based on your observations, does your child demonstrate sharing behaviors in daily life?" Both questions used a 4-point scale (1 = never, 4 = often). These two scores constituted parents' evaluations of children' s helping and sharing behaviors. In the teacher questionnaire, two teachers from each class evaluated the prosocial development level (e.g., helping others, sharing with others) of each child in their class who participated in this study using a 5-point scale (1 = low development level, 5 = high development level). We took the average of the two teachers' ratings as the teacher' s evaluation of the child' s prosociality.

3 Results

We will first report children' s performance on each task and its developmental pattern with age (means, standard deviations, and correlations with age for each task are shown in Table 1), and then report the analysis results of the relationship between theory of mind and social mindfulness understanding.

Table 1 Means (SD), ranges, and correlations with age (in months) of children' s scores on each task

Task	Mean (SD)	Range	Correlation with Age (months)
Social mindfulness understanding	0.66 (0.38)	0-1	0.23*
Theory of mind	0.61 (0.49)	0-1	0.24*
Sharing	1.71 (1.11)	0-5	-0.19
Executive function	90.83% (16.47%)	0-100%	0.21*

Note: * indicates significant correlation at the 0.05 level (two-tailed), ** indicates significant correlation at the 0.01 level (two-tailed)

3.1 Development of Social Mindfulness Understanding

In the social evaluation question ("For Bei Bei, who is a better friend, Huan Huan or Le Le?"), 60% of children chose the "choice-leaving character." In the friend preference question ("Who would you choose as your friend, Huan Huan or Le Le?"), 70% of children chose to befriend the "choice-leaving character."To explore developmental changes in children' s responses to these two questions with age, we conducted a binomial linear mixed effects model analysis (using the glmer function in R) with children' s responses (1 = chose socially mindful character, 0 = chose non-socially mindful character) as the dependent variable, question type (social evaluation, friend preference) as a within-subjects independent variable, and age as an independent variable. Results showed only a significant main effect of age (B = 1.07, SE = 0.46, 95% CI [0.17, 1.98], p = 0.020). Compared to younger children, older children more frequently answered "choice-leaving character" across both questions. No significant main effect of question type or interaction was found (ps $>$ 0.374). Figure 2 shows the relationship between the proportion of children choosing socially mindful characters on the two questions of the social mindfulness understanding task and age.

To further explore the main effect of age, we also estimated the precise age at which children significantly preferred characters demonstrating socially mindful behavior. Following Johnson and Neyman' s (1936) "regions of significance" method, we used the above mixed linear model to estimate marginal means (and their standard errors) at ages between 4 and 6 in increments of 0.1 years. This analysis indicated that from age 5.2, children significantly chose socially mindful characters more often in the friend preference question, and from age 5.5, children significantly chose socially mindful characters more often in the social evaluation question (as shown in Figure 2).

Figure 2 Relationship between proportion of children choosing socially mindful characters on the two questions of the social mindfulness understanding task and age (shaded areas represent 95% confidence intervals)

Additionally, we analyzed children' s open-ended explanations after the two questions. We coded and scored explanations: if children mentioned the concept of "leaving choices for others" (e.g., "because she left a banana and an apple, while he left two bananas," "because she left a choice"), they received a score of 1; otherwise, 0. Two researchers unaware of the study design coded children' s explanations according to these rules, with 91% coding consistency. In the social evaluation question, 39% of children mentioned "leaving choices for others" in their explanations. In the friend preference question, 29% of children mentioned this concept. Children' s explanations also showed a gradual developmental trend with age. Figure 3 shows the relationship between the proportion of children providing explanations mentioning "leaving choices for others" on the two questions and age. We conducted a binomial linear mixed effects model analysis with whether children' s explanations mentioned "leaving choices for others"as the dependent variable, question type as a within-subjects independent

variable, and age as an independent variable. Results showed a significant main effect of age (B = 2.11, SE = 0.72, 95% CI [0.69, 3.52], p = 0.003). No significant main effect of question type or interaction was found (ps > 0.06). That is, compared to younger children, older children more frequently mentioned "leaving choices for others" in their explanations across both questions.

Figure 3 Relationship between proportion of children providing explanations mentioning "leaving choices for others" on the two questions of the social mindfulness understanding task and age (shaded areas represent 95% confidence intervals)

3.2 Development of Theory of Mind

In the unexpected contents task, 62% of children answered correctly; in the unexpected location task, 71% answered correctly; and in the hidden emotion task, 67% answered correctly. Analyzing the three tasks together, 27% of children answered all three tasks correctly, 41% answered two correctly, 21% answered one correctly, and 11% answered all three incorrectly.

To explore developmental changes in children' s performance on theory of mind tasks with age, we first followed previous literature by averaging scores across the three tasks to calculate each child' s final theory of mind score. Figure 4 shows the relationship between children's theory of mind scores and age. Theory of mind scores were significantly positively correlated with age (in months), r(98) = 0.23, p = 0.021, indicating that older children performed better on theory of mind tasks.

Figure 4 Relationship between children's theory of mind scores and age (shaded areas represent 95% confidence intervals)

3.3 Sharing Task

In the sharing task, the mean number of stickers children shared was 1.71 (SD = 1.12). As shown in Figure 5, the number of shared stickers was not significantly correlated with age, r(98) = -0.19, p = 0.063.

Figure 5 Relationship between number of stickers children shared in the sharing task and age (shaded areas represent 95% confidence intervals)

3.4 Executive Function Task

Children' s mean accuracy on this task was 90.83% (SD = 16.47%). As shown in Figure 6, task accuracy was significantly positively correlated with age, r(98) = 0.21, p = 0.033, indicating that older children had higher accuracy on the executive function task.

Figure 6 Relationship between children' s accuracy on the executive function task and age (shaded areas represent 95% confidence intervals)

3.5 Relationship Between Social Mindfulness Understanding and Theory of Mind

Next, we analyzed whether children' s performance on the social mindfulness understanding task correlated with their performance on the theory of mind task. We first conducted bivariate correlation analysis (results shown in Table 2). Both questions in social mindfulness understanding and their average score were significantly positively correlated with theory of mind scores (ps $<$ 0.021). Since we found positive correlations between both social mindfulness understanding and theory of mind with age, we next conducted partial correlation analysis controlling for age. As shown in Table 2, after controlling for age, both questions in social mindfulness understanding and their average score remained significantly positively correlated with theory of mind scores (ps $<$ 0.041). Figure 7 shows the scatter plot and fitted curve of the relationship between social mindfulness understanding scores (average of the two questions) and theory of mind scores after controlling for age. This indicates that the better children performed on theory of mind tasks, the better their understanding and evaluation of social mindfulness.

Table 2 Bivariate and partial correlations (controlling for age) between children' s responses on the social mindfulness task and theory of mind scores

Measure	Bivariate correlation with theory of mind	Partial correlation with theory of mind (controlling for age)
Social evaluation question	0.23*	0.21*
Friend preference question	0.25*	0.20*
Social mindfulness understanding score	0.31**	0.26*

Note: * indicates significant correlation at the 0.05 level, ** indicates significant

correlation at the 0.01 level

Figure 7 Positive correlation between social mindfulness understanding scores and theory of mind scores (after controlling for age)

To specifically examine the effect of the number of theory of mind tasks passed on social mindfulness understanding, we conducted an ANOVA with social mindfulness understanding task scores as the dependent variable, number of theory of mind tasks passed (0, 1, 2, or 3) as the independent variable, and age as a covariate (see Figure 8). There was a marginally significant effect of the number of theory of mind tasks passed ($F(3, 95) = 2.68$, $p = 0.052$, $p^2 = 0.08$). Bonferroni-corrected post-hoc pairwise comparisons revealed that children who passed all three theory of mind tasks had significantly higher social mindfulness scores than children who passed zero tasks, $p = 0.039$, 95% CI [0.01, 0.74]. No other pairwise comparisons were significant (ps > 0.174). Similar results were obtained when analyzing the two questions in the social mindfulness understanding task separately.

Figure 8 Effect of number of theory of mind tasks passed on social mindfulness understanding scores (error bars represent standard errors, * indicates significant group difference at the 0.05 level)

To further explore the relationship between theory of mind and social mindfulness understanding, we conducted a series of linear regression analyses (results shown in Table 3). First, we conducted linear regression with social mindfulness understanding scores as the dependent variable and age as the independent variable, finding a significant age effect ($B = 0.19$, $SE = 0.08$, $t = 2.36$, $p = 0.020$). Next, we added theory of mind scores as an independent variable to the linear regression model, finding that the age effect became non-significant ($p = 0.084$) while the theory of mind effect was significant ($B = 0.31$, $SE = 0.12$, $t = 2.73$, $p = 0.008$). Moreover, compared to the linear regression analysis that only included age, this model significantly increased explained variance, F_{change}(1, 97) = 7.45, p = 0.008. Next, to examine whether the theory of mind effect was unique beyond prosocial orientation and executive function, we added executive function scores and sharing scores to the model. The theory of mind effect remained significant ($B = 0.30$, $SE = 0.12$, $t = 2.49$, $p = 0.014$), while other variables had no significant effects (ps > 0.13). Moreover, compared to the model that only included age and theory of mind, this model did not increase explained variance, F_{change}(2, 95) = 0.29, p = 0.75. This demonstrates that theory of mind has an important correlation with social mindfulness understanding, and this correlation remains robust after controlling for age, prosocial orientation, and executive function.

Table 3 Summary of linear regression models with social mindfulness understanding as the dependent variable

Model	Variables	B	SE	t	p	F_{change}
1	Age	0.19	0.08	2.36	0.020	5.58*
2	Age, Theory of mind	0.31	0.12	2.73	0.008	7.45**
3	Age, Theory of mind, Executive function, Sharing	0.30	0.12	2.49	0.014	0.29

Note: * indicates significant predictive effect at the 0.05 level, ** indicates significant predictive effect at the 0.01 level

3.6 Relationship Between Children' s Social Mindfulness Understanding and Prosocial Orientation/Executive Function

We explored whether children' s performance on the social mindfulness understanding task correlated with prosocial orientation (i.e., performance on the sharing task, parent and teacher ratings of prosociality) and executive function. Bivariate and partial correlation analyses (controlling for age) are shown in Table 4. As can be seen, social mindfulness understanding was not significantly correlated with the number of stickers children shared, teacher-rated prosociality, parent-rated helping frequency, parent-rated sharing frequency, or executive function (ps $>$ 0.118).

Table 4 Bivariate and partial correlations (controlling for age) between children' s social mindfulness understanding scores and prosocial orientation/executive function

Measure	Bivariate correlation	Partial correlation (controlling for age)
Sharing score	0.08	0.11
Teacher-rated prosociality	0.12	0.09
Parent-rated helping	0.06	0.08
Parent-rated sharing	0.04	0.06
Executive function	0.13	0.10

4 Discussion

4.1 Conclusions

The development of children' s prosocial behaviors and their evaluation of prosocial behaviors have always been hot topics in developmental psychology. In recent years, the development of social mindfulness as a type of prosocial behavior has gradually become a frontier research topic (Van Doesum et al., 2013; Dou, Liu, et al., 2018; Zhao, Zhao et al., 2021; Van Lange & Van Doesum, 2015). This study found that children consider whether a person demonstrates socially mindful behavior not only in their evaluations of others, but also in their friend selection. Moreover, such evaluations and preferences develop importantly between ages 4-6: 4-year-old children show no clear friend preference between characters demonstrating socially mindful (i.e., leaving choices for others) versus non-socially mindful behaviors (i.e., not leaving choices), but 5- to 6-year-old children prefer to befriend individuals who demonstrate socially mindful behaviors. More importantly, this study found that children' s social mindfulness understanding is significantly positively correlated with their theory of mind development, and this correlation remains stable after controlling for potential confounding variables including age, executive function (general cognitive ability), and prosocial orientation. Additionally, children's social mindfulness understanding is not correlated with prosocial orientation (including children' s own sharing behavior and parent/teacher ratings of children' s prosociality). Therefore, this study provides the first empirical evidence of a correlation between theory of mind development and social mindfulness understanding development.

4.2 Development of Social Mindfulness Understanding

This study found that 4- to 6-year-old children gradually develop preferences for characters demonstrating socially mindful behaviors in friend selection. This further complements previous findings that 4- to 6-year-old children gradually develop higher social evaluations of socially mindful behaviors (Zhao, Zhao et al., 2021). This demonstrates that whether others demonstrate socially mindful behavior not only affects children's evaluations of that person, but also influences whether children choose to befriend, play with, or even cooperate with them. This is consistent with adult research findings that adults are more inclined to cooperate with individuals who demonstrate socially mindful behaviors (Dou, Liu, et al., 2018). In summary, this study reveals the developmental pattern of this phenomenon in childhood, further confirming that social mindfulness understanding undergoes important development between ages 4 and 6, and further illustrating that socially mindful behaviors play an important role in interpersonal interaction.

Although this study only focused on evaluations of and friend preferences for socially mindful behaviors (because we consider these the most basic and important aspects of social mindfulness understanding), it should be noted that social mindfulness understanding is not limited to social evaluation and friend

preference. First, comprehensive understanding of social mindfulness also includes understanding its normativity—specifically, the extent to which children consider socially mindful behaviors as normative behaviors that everyone should follow, and whether non-socially mindful behaviors should be punished. Second, comprehensive understanding of social mindfulness also includes understanding its characteristics and scope of application—for example, whether children consider social mindfulness a stable trait or merely situational and temporary, and the extent to which children believe social mindfulness is influenced by contextual factors such as interaction partners. Third, social mindfulness understanding can also include children' s understanding of the motivations behind socially mindful behaviors—for example, whether children believe a person demonstrates socially mindful behavior out of pure altruistic motivation or to appear friendly to gain approval from the recipient or other observers. Future research needs to more comprehensively investigate various aspects of children' s social mindfulness understanding development.

4.3 Relationship Between Social Mindfulness Understanding and Theory of Mind

This study found a stable positive correlation between social mindfulness understanding and theory of mind, which remained significant after controlling for age, executive function, and prosocial orientation. This indicates that the correlation between theory of mind and social mindfulness is unique beyond general cognitive ability and cannot be explained by general cognitive ability (i.e., executive function). Why does such a stable and unique relationship exist between theory of mind and social mindfulness understanding? We believe that the development of children' s theory of mind can help children understand and evaluate socially mindful behaviors through two aspects: understanding the recipient' s preferences and understanding the actor' s intentions. On the one hand, an important aspect of theory of mind ability is understanding others' preferences and desires (Wellman, 2014). In social mindfulness situations, the recipient' s preferences are unknown (for example, in the dessert queue example, we don' t know whether Xiao Hong prefers strawberry or chocolate cake). The ability to understand others' preferences can help children comprehend that leaving two different options for the recipient can best satisfy their desires (i.e., they can choose their preferred cake). On the other hand, another important aspect of theory of mind ability is understanding others' intentions (Wellman, 2014), which can help children infer and understand the prosocial intentions behind the actor' s behavior—that is, understanding that the actor' s behavior aims to respect and protect the recipient' s needs and rights to choose, reflecting the actor' s kindness. However, more detailed research is needed to specifically examine how theory of mind influences children' s social mindfulness understanding (or which aspect of social mindfulness understanding it affects). It should be noted that although we found a correlation between social mindfulness understanding and theory of mind, they are two independent psychological concepts. As mentioned earlier, theory of mind refers to the general ability to understand others'

mental states (desires, beliefs, emotions, etc.) and thereby predict their behaviors (Premack & Woodruff, 1978; Wellman, 2014), while social mindfulness understanding is specifically the understanding and corresponding evaluation of prosocial behaviors that preserve others' right to choose.

Additionally, it should be noted that this study used a correlational design, and based on these results, causal inferences cannot be made. Future research could build on this study by using experimental manipulation methods to explore possible causal relationships between theory of mind and social mindfulness understanding—for example, investigating whether training to improve children's theory of mind abilities can promote the development of social mindfulness understanding, or using longitudinal designs to examine whether early theory of mind development in children predicts their social mindfulness understanding at later ages.

The correlation between social mindfulness understanding and theory of mind found in this study further demonstrates the importance of theory of mind in the development of children's social and moral evaluations, particularly in moral evaluations that require reasoning about deep intentions (rather than just surface behaviors). This is consistent with previous research findings (Killen et al., 2011; Smetana et al., 2012) showing correlations between intention-based social evaluations and theory of mind. These findings collectively provide possibilities for promoting moral cognitive development by enhancing children's theory of mind.

4.4 Social Mindfulness Understanding and Prosocial Orientation

This study also found that children's social mindfulness understanding is not correlated with prosocial orientation. First, in the behavioral test (i.e., sharing task), the number of stickers children shared was not correlated with their performance on the social mindfulness understanding task. Additionally, parent and teacher ratings of children's prosociality were not correlated with children's performance on the social mindfulness understanding task. Thus, whether measured through laboratory tasks or parent/teacher ratings of children's prosocial behaviors, we found no correlation between social mindfulness understanding and prosocial orientation. While this result may seem surprising, it is consistent with the widely found cognition-behavior gap in previous research on children's prosocial behaviors (Blake et al., 2014). We believe that this study focused on children's understanding of socially mindful behaviors, not their own socially mindful behaviors, which belongs to the cognitive level, while children's sharing behaviors and daily helping and cooperation behaviors belong more to the behavioral level. Therefore, the lack of correlation between cognitive understanding of social mindfulness and prosocial behaviors is reasonable to some extent. This suggests that in future research, on the one hand, we can explore whether children's understanding of socially mindful behaviors correlates with their social and moral evaluations of other prosocial behaviors; on the other hand, we can also explore whether children's own socially mindful behaviors

correlate with sharing behaviors and other prosocial behaviors (such as helping, cooperation, etc.).

4.5 Limitations and Future Directions

This study has several limitations that future research could address. First, this study only examined possible relationships between social mindfulness understanding and theory of mind, prosocial orientation, and executive function, but the development of children' s social mindfulness understanding may be very complex and influenced by many factors that remain to be explored. For example, children' s understanding of this prosocial behavior that preserves others' right to choose may be influenced by how much children themselves value choice (i.e., whether they consider having autonomous choice opportunities very important) (Iyengar & Lepper, 1999). Children who highly value autonomous choice rights may evaluate socially mindful behaviors particularly highly. Additionally, children' s social mindfulness understanding may also be influenced by whether they have experienced socially mindful or considerate behaviors in daily life. If children have personally experienced situations where others left them choices or deprived them of choices, they may have deeper understanding of socially mindful or non-socially mindful behaviors. Existing research on direct prosocial behaviors such as helping and sharing shows that after children experience others' prosocial behaviors toward them, they subsequently demonstrate more prosocial behaviors toward others (Chernyak et al., 2019; Warneken & Tomasello, 2013; Wörle & Paulus, 2019).

Second, the sharing task used in this study set the sharing target as a hypothetical child ("the child who will come to play next"), so children' s performance on the sharing task may be influenced by the specific person they imagined—for example, some children might imagine a friend while others might imagine a stranger. Previous research shows that sharing targets may affect children' s sharing behaviors (Blake, 2018; Moore, 2009). This suggests that in future research, we could replace the sharing target with specific individuals (e.g., friends, family members) to reduce potential extraneous effects from children imagining different people.

Third, this study' s sample was mainly limited to urban kindergarten children, and the sample size was limited. Future research could increase sample size and sample more broadly, such as including children from rural or less developed areas, to examine whether these results can be generalized to broader populations.

Finally, this study only focused on children' s understanding and evaluation of socially mindful behaviors as third-party observers and their relationship with theory of mind; no research has examined the development of children' s socially mindful behaviors as actors and their relationship with theory of mind and other variables. Future research could explore these angles.

In summary, based on previous theories and findings, this study is the first

to explore the underlying mechanisms of preschoolers' social mindfulness understanding, finding a stable and unique correlation between children' s theory of mind development and social mindfulness understanding development, which has important implications for research on children' s social mindfulness understanding, prosocial behaviors, and social and moral evaluations. Social mindfulness is ubiquitous in real life—a small act of kindness can promote cooperation and trust between people, and can be considered the "lubricant" of interpersonal relationships. We believe that studying children' s understanding of socially mindful behaviors and its developmental mechanisms can promote the development of children' s social interaction abilities and moral judgment, foster children' s own cooperative behaviors and the generation of interpersonal trust, and thereby further promote the construction of a harmonious society.

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† Due to uneven distribution of participants across age groups, we treated age (in months) as a continuous variable in analyses. Results were essentially the same when using age groups.

Note: Figure translations are in progress. See original paper for figures.

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