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Earlier false belief understanding predicts later lie-telling behavior in preschool children, but not vice versa

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Abstract

Young children's lie-telling behavior is associated with their theory of mind (ToM) development. However, current evidence is primarily based on cross-sectional studies, with very little longitudinal evidence on the causal relation between the two constructs. The current study provided much-needed cross-lagged longitudinal evidence on the association between ToM and lying in young children. Adopting a short-term longitudinal design, we tested 104 normally developing children's (64 boys, $M = 54.0$ months) false belief understanding and lie-telling behaviors three times at 4-month intervals. Results showed the cross-lagged model fit the data well. Lie-telling behaviors exhibited moderate stability across the three time points, while ToM exhibited moderate stability between the first two time points but not between Time 2 and Time 3. Earlier false belief understanding significantly predicted children's later lie-telling behavior, controlling for family socioeconomic status, child age, gender, only child status, and Time 1 verbal ability and inhibitory control. On the contrary, earlier lie-telling did not predict later false beliefs understanding. We concluded that

earlier false belief understanding predicts later lie-telling behavior in preschool children, but not vice versa.

KEYWORDS
false belief understanding, lie-telling behavior, longitudinal study, preschool children, theory of mind

1 | INTRODUCTION

Lying is the intentional deception to benefit either oneself or other people (Talwar et al., 2017). Theory of mind (ToM), the ability to infer others' mental states (Wellman, 2014), enables children to understand what others know or do not know and hence be able to manipulate others' beliefs through lying (Lee, 2013). ToM as a cognitive tool is essential for children's interpersonal functioning, enabling both prosocial behaviors and calculative Machiavellianism (Repacholi et al., 2003). The ability to understand and appreciate that others might think and believe differently from self could function as a mental facilitator and a social lubricant in interpersonal communications and interactions. Children with more advanced ToM abilities are more prosocial, more popular among peers, and less aggressive (Ekerm-Akbulut et al., 2023; Imuta et al., 2016; Slaughter et al., 2015; Wang et al., 2023). Seemingly contradictory, children's ToM also predicts their lie-telling behavior (Lee & Imuta, 2021; Sai et al., 2021). This might be explained by examining the function of lie-telling behaviors. Indeed, lying is an autonomous social exchange strategy to either benefit self or others while avoiding confrontations (Wang et al., 2017), and ToM could provide children with the cognitive tool to do so (Talwar & Lee, 2008).

Prior findings on the relationship between children's ToM and their lie-telling behaviors were mixed. While some studies reported that ToM ability is significantly correlated with children's anti-social lie-telling (e.g., Ma et al., 2015; Talwar et al., 2017), others failed to identify a concurrent association (Wang et al., 2017). Recent meta-analysis reports revealed statistically significant but small effect-sized associations between children's ToM and lie-telling behavior (Lee & Imuta, 2021; Sai et al., 2021). However, the studies included in the meta-analyses were mostly cross-sectional, with little longitudinal evidence of the causal relation between the two constructs. The available evidence was from training studies demonstrating that training children's ToM caused previously honest children to lie in the hide-and-seek task for personal gain (Ding et al., 2015), while training children to deceive in the hide-and-seek task also improved their ToM (Ding et al., 2018), suggesting a bi-directional relation between ToM and lie-telling. However, it is worth noting that the training evidence was stronger in the ToM leading to lie-telling direction (Ding et al., 2015) than the other way around (Ding et al., 2018). The ToM training effect on children's lie-telling was evident 1 month after the training ended (Ding et al., 2015), while in Ding et al. (2018), the post-test took place the day after 4 days of lie training. The boost in the training group's false belief understanding performance at the post-test in this study might be a short-term spike due to repeated practice of perspective-taking.

A longitudinal study is another approach to determining the direction of association between children's ToM and lie-telling behavior. However, available longitudinal evidence on the association is also equivocal in both the strengths of the association and the direction of causation. Talwar et al. (2019) measured children's prosocial lie-telling and both instrumental and transgression antisocial lie-telling 2 years apart at 4-years and 6-years respectively, alongside with executive functions and false belief understanding, an important ToM landmark in early childhood (Wellman et al., 2001). Transgression antisocial lies are usually measured with a temptation resistance task assessing children's cover-up of their transgression to avoid negative consequences (Wang & Wang, 2018). In this task, children are left alone briefly with a covert toy of which they need to guess the identity. They would be asked later whether they have peeked at the toy to assess their lie-telling and to justify why they think it is what they claim to be to assess semantic leakage control. In comparison, instrumental lie-telling entails proactively providing false information in competitive

zero-sum games to maximize personal gain. For example, Ding and colleagues' training studies (Ding et al., 2015; Ding et al., 2018) adopted a hide-and-seek task where children are asked where they have hidden a sticker. They could keep the sticker only if they lie about the true location. Talwar et al.'s (2019) longitudinal study reported that while individual children's instrumental lies were consistent over time, their transgression lies were not. This suggests that instrumental lie-telling likely reflects a more stable individual characteristic associated with persistent antisocial behaviors (Mugno et al., 2019), whereas transgression lies are more context-dependent. Surprisingly, children's lie-telling behaviors were not associated with their ToM or executive functions concurrently or longitudinally in Talwar et al. (2019).

In a three-wave cross-lagged design, Zhao et al. (2021) adopted a ToM scale (Wellman & Liu, 2004) to examine the longitudinal association between ToM and lie-telling in a hide-and-seek task among 3–4-year-old children with 4-month intervals. They found that young children's understanding that people might have different desires (*diverse desires*) at Time 1 (T1) predicted their lie-telling behavior at Time 2 (T2); and their understanding of "seeing is knowing" (*knowledge access*) and inhibitory control at T2 marginally predicted lie-telling at Time 3 (T3). However, false belief understanding was not associated with children's lie-telling behavior. Given the increasing difficulty levels from *diverse desires* to *knowledge access* to *false belief* in the ToM scale progression (Wellman & Liu, 2004), this finding suggested that age-related mental state understanding abilities might be inducive to children's lie-telling behavior. Lying did not predict children's performances on the ToM tasks longitudinally with one exception. Zhao et al. (2021) reported that lying at T2 negatively predicted children's understanding of emotion based on a false belief (*belief-emotion*) at T3, likely due to the more honest children's sensitivity to the experimenter's feelings.

The discrepancies between the findings of Talwar et al. (2019) and that of Zhao et al. (2021) might be attributed to differences in the participants' age and the time intervals between waves of assessment. Talwar et al. (2019) found no longitudinal associations between children's lie-telling and their ToM when assessed 2 years apart between 4- and 6-years of age. In contrast, Zhao et al. (2021) reported stronger evidence for the direction that earlier ToM predicts later lie-telling than vice versa in a younger group of children between 3- and 4-years of age, assessed three times with 4-month intervals. These contrasting results highlight the need for further longitudinal studies to identify the direction of causation between children's lie-telling and their developing ToM (Lee & Imuta, 2021; Sai et al., 2021).

To summarize, although meta-analyses (Lee & Imuta, 2021; Sai et al., 2021) identified small but significant concurrent associations between children's false belief understanding and lie-telling behavior, there is a lack of definitive evidence on the direction of association. Both training studies (Ding et al., 2015; Ding et al., 2018) and longitudinal studies (Talwar et al., 2019; Zhao et al., 2021) seem to provide stronger evidence supporting the causal direction from earlier ToM to later lie-telling than the other way around, in line with Lee's (2013) argument that lie-telling is ToM in action. Based on these findings, the current study hypothesized that children's earlier false belief understanding would predict their later lie-telling behavior, but not vice versa.

We adopted a more rigorously designed longitudinal study with age-sensitive assessments to examine the cross-lagged longitudinal associations between children's false belief understanding and their instrumental lie-telling. A three-time-point longitudinal design with 4-month intervals enables us to explore the consistency of the causal associations over time and to discern whether children's developmental stage affects the directionality and strength of the relations. Given its cross-age consistency, children's instrumental lie-telling was assessed in the current study using the hide-and-seek paradigm, which requires the fabrication of information to manipulate others' mental states, hence more sophisticated than simple denials to conceal transgression (Talwar et al., 2019). "Seeing is knowing" has been identified as a predictor of children's lie-telling (Zhao et al., 2021). Indeed, understanding knowledge access enables children to evaluate what others know or do not know (i.e., ignorance). However, the key ToM ability in lie-telling is to manipulate others' beliefs, or create false beliefs for others. As such, the current study adopted false belief understanding as a ToM indicator. First-order false belief understanding was assessed at each time point. To capture 4–5-year-old children's developing ToM, an additional second-order false belief understanding task was added at T3. Lie-telling requires inhibitory control to suppress the urge to tell the truth (Carlson et al., 2002). We

assessed children's inhibitory control at T1 as a control variable. Given the well-established association between ToM and verbal ability during early childhood (Milligan et al., 2007), we also measured children's verbal ability at T1.

2 | METHOD

2.1 | Participants

A convenient sample of 104 children aged between 46 and 64 months (54 girls, $M = 54.0$ months, SD = 3.65) were recruited from two kindergartens in Zhuji, China. A power analysis using G*Power (version 3.1; Faul et al., 2009) was conducted to determine if the sample size was enough to detect a significant effect. The power analysis was based on a desired power (1-β) of .80, an α of .05, and an anticipated medium effect size of $f^2 = .15$. Results showed that 103 participants were required to detect a significant effect of ToM on children's lying, after controlling for the influence of language, inhibitory control, children's age, gender, sibling status, and family SES in a linear multiple regression.

The city of Zhuji is located in a developed area in Eastern China, with an average monthly personal income of RMB6781 in 2022 (Zhuji Municipal Government, 2023), making the estimate for the monthly household income based on a double income at RMB13,562. Out of the 104 children, 60.6% ($n = 63$) had siblings while the rest were only children. Children were predominately Chinese in ethnicity and fluent in Mandarin Chinese. The primary caregivers reported both parents' educational levels (*1 = primary school; 2 = secondary school; 3 = college; 4 = master degree; and 5 = doctoral degree or above*) and their household monthly income (*1 = below RMB5000; 2 = RMB5001–10,000; 3 = RMB10,001–RMB15,000; and 4 = RMB15,001 and above*) on ordinal scales. Both the median and mean statistics of the family's monthly income were within the range of RMB10,001–RMB15,000, on par with the average household income of the region. Out of all the parents, 81.4% of mothers and 80.4% of fathers had post-secondary education. A composite score of socioeconomic status (SES) was created with the sum of the father's and mother's educational levels and the family income level on ordinal scales, with a mean score of 9.37 (SD = 1.95, range = 5–15).

2.2 | Procedures

The study procedure was reviewed and approved by a university's human research ethics committee. Written informed consents were received from both the kindergarten principals and the individual children's parents or legal guardians before the commencement of the study. Parents reported family socioeconomic status and only child status at T1. Trained experimenters administered the tests to individual children in a quiet room within their kindergartens at each time point. A different pair of experimenters met with individual participants at each time point to administrate the tasks. Children participated in the false belief tasks first, then the hide-and-seek task, followed by the inhibitory control task and the Bus Story task. At T2 and T3, children again finished the false belief tasks first, followed by the hide-and-seek task.

2.3 | Measures

2.3.1 | Lie-telling behavior

The hide-and-seek deception task (Chandler et al., 1989; Ding et al., 2015; Sodian et al., 1991) was used to assess children's lie-telling behavior. The task started with three warm-up trials in which the experimenter played a simple

hide-and-seek game without deception with the children. The experimenter hid a sticker under one of two identical paper cups that were placed upside down and asked the children to guess where the sticker was. The children would "win" the sticker if they guessed it correctly, otherwise, the experimenter kept the sticker. The experimenter explained the rules of the game to the children while playing. After the warm-up, the experimenter told the children it was their turn to hide the stickers for the experimenter to guess. In each of the following 10 trials of the deception task, the experimenter closed her eyes while the children hid the sticker. When the children announced that they had finished hiding the sticker, the experimenter opened her eyes and asked, "Where did you hide the sticker?" The experimenter always guessed the cup that the children indicated to have hidden the sticker. Children's responses were coded as "truth-telling" when they indicated the cup where the sticker was really hidden, in which case the experimenter took the sticker and said, "I won! It is my sticker. Let's do it again." Children were given 1 point for lying about the location of the hidden sticker by indicating the empty cup, in which case the experimenter seemed disappointed and stated, "I lost. It is your sticker now. Let's do it again." The maximum score for lying was 10.

2.3.2 | False belief understanding

Children participated in two first-order false belief tasks at each time point with slightly modified hiding locations or contents to avoid repeated measure effects. An additional second-order location false belief task was added at T3 to better reflect children's more advanced ToM ability with age.

First-order location false belief task (Wimmer & Perner, 1983). Children were told a story about two characters which was enacted with figurines and props. One character left an object at location A and left the scene. The other character relocated the object to location B. Children were asked a memory control question about the original location of the object. Children were then asked where the first character would look for the object upon return and why. Children had to answer that the character would look for the object at location A to be credited as correct. For the explanation question, children had to mention that the first character did not know or see the location change to be credited. Those who passed the control question received 1 point for an accurate response to each test question, making the maximum score for this task 2.

First-order content false belief task (Gopnik & Astington, 1988). The experimenter showed children a package of a commercial product with clear labels and pictures (e.g., Band-Aid plasters or Colgate toothpaste) and asked children to guess what was inside the package. Most children replied that the package should contain something consistent with the label, like Band-Aids or toothpaste. The unsure few were prompted, for example, "Do Band-Aid cases usually have Band-Aids inside?." The experimenter then opened the package to reveal the actual contents of the package which were either crayons or pencils. The package was sealed again with the contents inside. Children were asked a reality control question about the true contents of the package, a representational change question, "Before you looked inside, what did you think was inside the case?," and a false belief question, "This girl has not seen what is inside this case. If she sees it all closed up like this, what will she think is inside the case?." Children who failed the reality control question were not given any points. Those who passed the control question received one point for correctly answering each of the test questions, making the maximum score for this task 2.

Second-order location false belief task (adapted from Flobbe et al., 2008). In addition to the two first-order false belief tasks, children also finished a second-order location false belief task at T3. The story was depicted with colored drawings. In the story, Mom and Xiaoming were preparing a surprise birthday present for Dad in the bedroom. They hid the present under the blue bed so that Dad could not find it. While Mom was out buying a birthday card, Xiaoming wanted to play a trick on Mom. He took the present out and hid it again under the pink bed. Mom happened to pass the bedroom window and saw Xiaoming moving the present. Mom now knew the present was hidden under the pink bed. Xiaoming was busy hiding the present and did not notice that Mom was watching him through the window. At this point, children were asked a reality control question, "Where is the present now?." When Mom came back with the birthday card, she went to the bedroom to put the card in the present. Children were asked a second-order false

belief question, "Where does Xiaoming think Mom will look for the present?" and a justification question, "Why would he think that?." Children had to answer that Mom would look for the present under the blue bed to be credited as correct. For the justification question, children had to mention that Xiaoming did not know Mom was watching or knew about the location change of the present to be credited. Children received 1 point for correctly answering the second-order false belief question, and another point for the justification question, making the maximum score for this task 2.

2.3.3 | Verbal ability

A Chinese version of the Bus Story Test (Renfrew, 1997) was administered at T1. The Bus Story Test measures both receptive and expressive language abilities where children need to retell a story told by the experimenter with pictorial stimuli as prompts. Children's narratives were digitally recorded and transcribed verbatim for coding. Two independent raters coded the number of information elements in the narratives based on 20% of the transcripts, and the intraclass correlation coefficient (ICC) was high at .95. Five children either did not respond to the instructions or their responses were not recorded. Their data on this task were treated as missing.

2.3.4 | Inhibitory control

Children's inhibitory control was measured with the Simon Says task (Carlson & Wang, 2007) at T1, where children need to perform the instructed actions (e.g., Touch your nose) only when they hear *Simon says* before the instruction. Children need to inhibit a prepotent response and remain still if the experimenter does not say *Simon says* before the instruction. The task began with two practice trials with feedback. The formal test contained 40 trials, half of which included *Simon says*, in a fixed interspersed order without feedback. Each trial was rated as no movement, partial movement or self-correction, or full movement. The scoring followed Carlson and Wang's (2007) method and ranged from 0 to 2 by trial type. The total score ranged from 0 to 80, with higher scores indicating advanced levels of conflict inhibition. A trained research assistant rated children's performance in real time during the assessment. One child did not finish the Simon Says task and was treated as missing data.

2.4 | Analytic plan

Data were analyzed in two steps using SPSS and Mplus (Muthén & Muthén, 2017). First, we examined the descriptive statistics and bivariate correlations among all variables. Second, we performed crossed-lagged path analyses to test the longitudinal relation between ToM measured with false belief understanding tasks and lie-telling behaviors. The cross-lagged model captures both the stability of a construct across time and the cross-construct relations (Selig & Little, 2012). T3 lie-telling was regressed onto T2 ToM and lie-telling, and T2 lie-telling onto T1 ToM and T1 lie-telling. In parallel, T3 ToM was regressed onto T2 ToM and lie-telling, and T2 ToM onto T1 ToM and T1 lie-telling. The current model allowed the predictors to inter-correlate with each other and examined the longitudinal association between ToM and lie-telling behaviors, controlling for family SES, child age, gender, only child status, verbal ability, and inhibitory control. The covariates were regressed onto ToM and lie-telling behaviors at T1, T2, and T3. Out of the 104 children at T1, 102 completed the tasks at T2, and 92 completed T3. Full maximum likelihood estimation with robust standard errors was used to account for the missing data. Model fit was evaluated by comparative fit index (CFI > .90), root mean square error of approximation (RMSEA < .08), and standardized root mean square residual (SRMR < .08) (Hu & Bentler, 1999).

TABLE 1 Descriptive statistics of all measured tasks.

		Mean	SD	Range	Skewness	Kurtosis
T1	Location FBU	1.42	.82	0–2	−.93	−.87
	Content FBU	1.07	.90	0–2	−.13	−1.75
	Hide and seek	4.18	4.06	0–10	.23	−1.65
	Simon says	45.07	9.27	24–72	1.57	2.15
	Bus story	20.91	9.38	1–37	−.50	−.51
T2	Location FBU	1.79	.55	0–2	−2.54	5.23
	Content FBU	1.59	.69	0–2	−1.40	.53
	Hide and seek	7.02	3.49	0–10	−.94	−.51
T3	Location FBU	1.88	.44	0–2	−3.76	13.20
	Content FBU	1.63	.62	0–2	−1.50	1.12
	Second-order location FBU	1.31	.96	0–2	−.67	−1.59
	Hide and seek	6.99	3.37	0–10	−.95	−.38

Note: $N = 104$.
Abbreviation: FBU, false belief understanding.

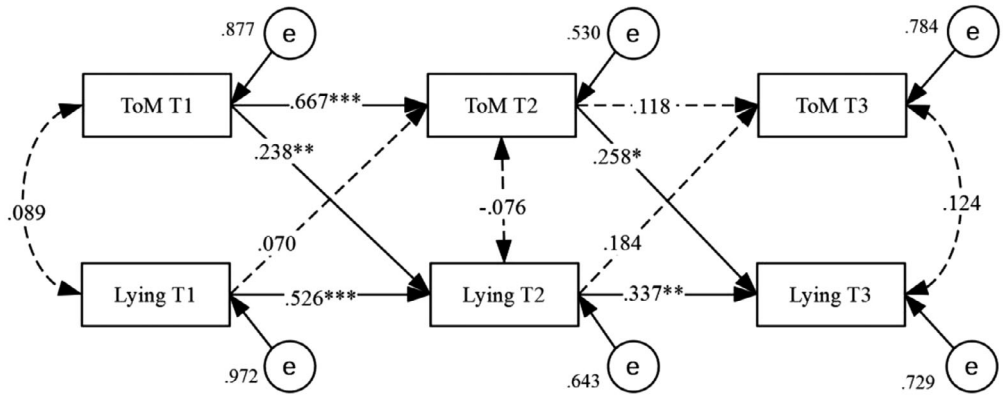

FIGURE 1 Cross-lagged longitudinal model. *Note*: ToM, theory of mind; Estimates reported here were controlling for the influence of T1 covariates, including family socioeconomic status, child age, gender, only child status, verbal ability, and inhibitory control.

3 | RESULTS

Descriptive statistics of all measured tasks were presented in Table 1. Children's performances on the first-order false belief understanding tasks were reaching the ceiling at T3, highlighting the necessity of adding a second-order false belief task at T3. Using the sums of false belief understanding scores at each time point, Table 2 presented the descriptive statistics and correlations among all the variables used in the path analyses. The ToM scores across three time points were correlated with small to medium effect sizes, and so were the lie-telling scores.

The cross-lagged model (Figure 1) fits the data well, $\chi^2(4) = .867$, $p = .929$, CFI = 1.000, TLI = 1.000, and RMSEA = .034. Lie-telling behaviors exhibited moderate stability across the three time points ($\beta = .526$, $p < .001$ from T1 to T2; $\beta = .337$, $p = .001$ from T2 to T3). ToM exhibited moderate stability between the first two time points ($\beta = .667$, $p < .001$) but not between T2 and T3 ($\beta = .118$, $p = .345$). Controlling for family SES, child age, gender, only child

TABLE 2 Descriptive statistics and bivariate correlations among all the variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	–											
2. Gender	–	–										
3. Only child	–	–	–									
4. SES	−.01	−.01	−.13	–								
5. Bus story	.22*	−.00	−.12	.22*	–							
6. Simon says	.10	−.04	−.15	.00	−.07	–						
7. ToM T1	.19	.01	.04	−.03	.18	.24*	–					
8. ToM T2	.12	.08	.06	−.01	.18	.09	.66***	–				
9. ToM T3	.28**	.14	−.14	−.02	.13	.24*	.28**	.24*	–			
10. Lying T1	.01	.01	−.07	.05	.04	−.06	.07	.11	.13	–		
11. Lying T2	.02	.01	−.04	.10	.06	−.01	.23*	.16	.18	.53***	–	
12. Lying T3	.13	.02	−.10	−.10	.13	−.11	.21*	.27*	.17	.23*	.35***	–
Mean	54	–	.61	9.36	20.91	45.07	2.86	3.38	4.82	4.18	7.02	6.99
SD	3.65	–	.49	1.95	9.38	9.27	1.17	1.09	1.48	4.06	3.49	3.37
Range	46–64	–	–	5–15	1–37	24–72	0–4	0–4	0–6	0–10	0–10	0–10
Skewness	.287	−.078	−.439	.614	−.497	1.570	−.791	−1.943	−1.036	.231	−.942	−.948
Kurtosis	−.645	−2.033	−1.843	.488	−.505	2.148	−.097	3.158	.208	−1.635	−.507	−.378

Note: $N = 104$.

Abbreviations: SES, socioeconomic status; ToM, theory of mind.

status, verbal ability, and inhibitory control, there was a significant cross-lagged association between T1 ToM and T2 lying ($\beta = .238$, $p = .002$) and between T2 ToM and T3 lying ($\beta = .258$, $p = .021$). There was no significant cross-lagged association between earlier lying and later ToM ($ps > .05$). Regression coefficients of path related to covariates can be found in Table S1.

4 | DISCUSSION

The current study examined the longitudinal associations between children's false belief understanding and their lie-telling behavior during early childhood. We found that earlier false belief understanding predicted children's later lie-telling, controlling for child and family characteristics and cognitive correlates, but not vice versa. To the best of our knowledge, this is the first evidence of the longitudinal causal link between false belief understanding and children's lie-telling behavior.

Lie-telling is dubbed as ToM in action (Lee, 2013). Understanding that other people could have beliefs different from your own or the reality provides children with the affordances to alter others' beliefs through lying. Morality aside, lie-telling is a form of sophisticated strategic social exchange that entails constant tracking of others' changing mental states, active manipulation of beliefs, and simultaneous pursuit of goals. Children with more advanced mental state understanding are better equipped with the cognitive skills to be better liars (Talwar & Lee, 2008). While meta-analyses have reported small but significant correlations between children's ToM and lie-telling behaviors predominately based on cross-sectional studies with *r*s ranging from .17 (Sai et al., 2021) to .23 (Lee & Imuta, 2021), the current study found no significant concurrent associations at three time points, consistent with some previous reports (Talwar et al., 2019; Wang et al., 2017). However, the current bivariate correlations of .16 at T2 and .17 at T3 are comparable to that reported by Sai et al.'s meta-analysis (2021).

The most noteworthy contribution of the current study was identifying the longitudinal link between children's earlier false belief understanding and their later lie-telling while controlling for family socioeconomic status, child age, gender, only child status, and T1 verbal ability and inhibitory control, indicating a causal role of ToM in children's lie-telling behavior. However, earlier lie-telling did not predict later false belief understanding. This finding supported Ding et al.'s (2015) conclusion that training false belief understanding caused previously honest children to lie by providing the much-needed longitudinal evidence, yet contradicted the report that training children to lie could boost their short-term performance on ToM (Ding et al., 2018), suggesting that ToM as a cognitive tool is more likely to predict social behaviors than the other way around. The current findings also extended Zhao et al.'s (2021) report that earlier ToM abilities such as knowledge access understanding predicted later lie-telling in younger children, but earlier lie-telling behavior did not predict later ToM scale tasks. The false belief understanding tasks adopted in this study not only aligned with the key mental state understanding ability in lying, they also captured the individual differences and developmental changes in the current sample with sensitivity.

The robustness of the current finding was supported by the three-time-point longitudinal design, which enabled us to explore the consistency of the directionality and the strength of the associations between variables over time. The path analysis revealed that while earlier lie-telling did not predict later false belief understanding, T1 false belief understanding predicted T2 lie-telling and T2 false belief understanding predicted T3 lie-telling with comparable effect sizes across time points. The finding indicated that, at least among 4- and 5-year-old children, early false belief understanding consistently predicted later lie-telling behavior with comparable strength across times. Taken together, the current findings provided robust evidence suggesting that children's developing ToM enabled them to manipulate others' beliefs and hence become better liars.

The bivariate correlation between T1 ToM and T2 ToM was strong at .66, but the correlations between T1 ToM and T3 ToM, as well as that between T2 ToM and T3 ToM were small at .28 and .24, although still statistically significant. It is worth noting that T3 ToM measure was different from that at T1 and T2 in that it included an additional second-order false belief task to better reflect children's developing ToM. The second-order false belief task requires higher

verbal ability and working memory, which might mask the strength of correlations between T3 ToM and previous ToM scores. Yet, T3 ToM was still correlated with child age and inhibitory control at T1, indicating a valid measure for this age group. In contrast, children's lie-telling behaviors were stable across three time points. This finding was consistent with Zhao et al.'s (2021) and Talwar et al.'s (2019) reports, indicating instrumental lies are consistent over time.

We conclude that young children's earlier false belief understanding predicts their later self-serving instrumental lie-telling, but not vice versa. While Ding et al. (2018) argued that children should be encouraged to play deceptive games, our current findings suggest that ToM could be informative in selecting players for competitive zero-sum games such as chess instead.

4.1 | Limitation

The current study is not without caveats. Firstly, it is limited by the fact that only spontaneous self-serving lying was assessed. Meta-analyses (Lee & Imuta, 2021; Sai et al., 2021) found that both antisocial lies and prosocial lies were correlated with ToM with comparable effect sizes. Furthermore, lie maintenance correlated much stronger with ToM than lie production did. Future research is warranted to identify whether ToM abilities predict lie maintenance in longitudinal studies. Secondly, while the current study focused on false belief understanding as a ToM indicator, there is evidence that understanding the interlocutor's emotional state might influence children's lie-telling behavior (Zhao et al., 2021). Examining the multifaceted ToM construct in relation to children's lying should be prolific. Lastly, the tasks at all three time points were administered following a fixed sequence for logistic convenience, which might pose a threat to the measurements' internal validity. Better randomization is needed in future studies.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available at https://osf.io/efx8v/?view_only=6843c23f840f47ceade3ee7a5ebc88a8.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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