Published in final edited form as:
Dev Psychol. 2011 January ; 47(1): 39–49. doi:10.1037/a0020787.

When All Signs Point to You: Lies Told in the Face of Evidence

Angela D. Evans,
Gould School of Law, University of Southern California

Fen Xu, and
State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University and School of Life Sciences, Zhejiang Sci-Tech University, Hangzhou, China

Kang Lee
Institute of Child Study, University of Toronto, Toronto, Ontario, Canada, and Department of Psychology, University of California, San Diego

Abstract

Young children's ability to tell a strategic lie by making it consistent with the physical evidence of their transgression was investigated along with the sociocognitive correlates of such lie-telling behaviors. In Experiment 1, 247 Chinese children between 3 and 5 years of age (126 boys) were left alone in a room and asked not to lift a cup to see the contents. If children lifted up the cup, the contents would be spilled and evidence of their transgression would be left behind. Upon returning to the room, the experimenter asked children whether they peeked and how the contents of the cup ended up on the table. Experiment 1 revealed that young children are able to tell strategic lies to be consistent with the physical evidence by about 4 or 5 years of age, and this ability increases in sophistication with age. Experiment 2, which included 252 Chinese 4-year-olds (127 boys), identified 2 sociocognitive factors related to children's ability to tell strategic lies. Specifically, both children's theory-of-mind understanding and inhibitory control skills were significantly related to their ability to tell strategic lies in the face of physical evidence. The present investigation reveals that contrary to the prevailing views, even young children are able to tell strategic lies in some contexts.

Keywords

executive functioning; theory of mind; deception; children

The study of lying dates back as early as Charles Darwin (1877), who observed his son telling lies at about 2 years of age. Darwin made two conclusions from his original observation. First, when children transgress and leave behind evidence, even at a very young age, they are motivated to cover up their transgression by lying. Second, although young children are motivated to tell lies, they do not yet know how to use language to strategically cover up their misdeeds, failing to make their statements consistent with evidence of their transgression (Darwin, 1877).

Following Darwin's initial examination of young children's lie-telling and Hartshone and May's (1928) subsequent work with older children, the study of children's deceptive

Correspondence concerning this article should be addressed to Fen Xu, State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, Beijing, 100875 or Kang Lee, Institute of Child Study, University of Toronto, 45 Walmer Road, Toronto, ON, Canada M5R 2X2. fenxu@bnu.edu.cn or kang.lee@utoronto.ca.

behaviors remained largely unexamined until the late 1980s when Lewis, Stanger, and Sullivan (1989) revived the field. In the last three decades, developmental psychologists have shown a renewed interest in children's ability to produce lies (Lewis, 1993; Peskin, 1992; Talwar & Lee, 2002a, 2002b; Talwar, Lee, Bala, & Lindsay, 2002, 2004; see also Lee, 2000; Lee & Evans, in press, and Talwar & Lee, 2008, for a review). The investigation of deception has been of interest for researchers for both theoretical and practical purposes. Specifically, the study of children's lying behavior has advanced researchers' understanding of theory-of-mind development (e.g., Chandler, Fritz, & Hala, 1989; Peskin, 1992; Polak & Harris, 1999) and moral development (e.g., Fu, Evans, Wang, & Lee, 2008). In addition, researchers' understanding of children's lie-telling behavior has been applied to moral education programs in schools and has been used in the court system for assessing children's credibility as witnesses (Chagoya & Schkolne, 1986; Goodman et al., 2006; Heyman, Luua, & Lee, 2009; Lyon, 2000; Stouthamer-Loeber, 1986; Strichartz & Burton, 1990; Talwar & Lee, 2008; Talwar et al., 2002, 2004).

One common method used to assess children's lie-telling behavior is the temptation resistance paradigm. This paradigm allows researchers to observe children in a naturalistic situation in which deception may occur. In this paradigm, children are typically left alone in a room with an exciting toy. Prior to leaving the child alone, the experimenter explicitly asks the child not to either touch or look at the toy while the experimenter is out of the room. Because it is extremely tempting, many children transgress and violate the experimenter's request. Upon returning to the room, the experimenter asks children whether or not they touched (or looked at) the toy while the experimenter was gone. This question assesses children's inclination to tell a lie or the truth after committing a transgression. To date, studies have demonstrated that children begin to tell lies during the preschool years, with approximately one third of 3-year-olds telling lies, and the proportion of children who lie increasing significantly with age (Chandler et al., 1989; Lewis et al., 1989; Peskin, 1992; Polak & Harris, 1999; Talwar & Lee, 2002a, 2002b; Talwar, Murphy, & Lee, 2007; Wilson, Smith, & Ross, 2003). These results demonstrate that children are motivated to lie to conceal a transgression, thus confirming Darwin's first conclusion.

Darwin's second conclusion was that young children are not able to use language strategically to cover up their misdeed. On the basis of Darwin's observation of his son, *strategic lie-telling* can be defined as a lie-teller taking into consideration information that is available to the lie recipient and making a false statement that is consistent with the information to elude possible detection. To date, researchers have examined strategic lie-telling in children through the use of follow-up questions in the temptation resistance paradigm. When children have lied about their transgression (stating that they did not peek at or play with the toy, when they in fact did), they are asked follow-up questions (e.g., "What do you think the toy is?" and "How did you know that?"). These questions are used to assess whether children are able to make follow-up false statements consistent with their initial claim that they have not played with or peeked at the toy (e.g., by feigning ignorance to the toy's identity). By maintaining the consistency between these follow-up statements and their initial false claim, their transgressions can be strategically concealed and their lies undetected.

It has been consistently found that most children 5 years of age and younger and about half of 6- to 7-year-olds fail to lie strategically when responding to the follow-up questions. They often blurt out the name of the toy, thereby contradicting their initial lie that they had not played with or peeked at the toy (Polak & Harris, 1999; Talwar & Lee, 2002a, 2008), and confirming Darwin's second conclusion. In contrast, older school-age children are able to lie strategically by feigning ignorance about the identity of the toy and providing plausible explanations for their knowledge of the toy (Talwar, Gordon, & Lee, 2007). Thus, it has been suggested that although younger children are able to tell lies, their ability to lie strategically is very limited, and such ability is only acquired in the elementary school years.

One possible explanation for why younger children have difficulty in telling such a strategic lie is that feigning ignorance requires the child to "assess a belief about a belief, namely what the adult will be able to infer from any knowledge of the contents revealed by the self" (Polak & Harris, 1999, p. 567). In other words, children must be able to have a second-order false-belief understanding to lie strategically (the second-order theory-of-mind hypothesis; Polak & Harris, 1999, and Talwar & Lee, 2002a). Recent evidence (Talwar, Gordon, & Lee, 2007) supports this hypothesis. With second-order theory-of-mind understanding only emerging around 6–7 years of age and not fully developing until adolescence, strategic lying by feigning ignorance has been found to be significantly correlated with older children's second-order theory-of-mind understanding (Talwar, Gordon, & Lee, 2007).

However, to date, children's ability to tell a strategic lie has been assessed by evaluating children's ability to be consistent with existing verbal evidence (i.e., their initial lie) and has failed to examine strategic lies that are told to be consistent with physical evidence, which may reduce requirements for second-order theoryof- mind understanding. For example, when trying to steal a cookie, a child may break a cookie jar on the kitchen counter. When asked by the parents, the child may deny having broken the cookie jar and then explain away the breakage of the cookie jar by strategically blaming the family cat. In this case, the lie-teller's primary task is not to make the explanations consistent with the initial denial but rather to make them plausible and consistent with the existing physical evidence that the cookie jar is broken. Thus, the need to make inferences about what the lie recipient might believe based on the lie-teller's initial verbal statement is reduced. Additionally, younger children may be able to tell strategic lies by making false statements that are consistent with the existing physical evidence. Although previous studies to date have examined children's nonverbal deception when physical evidence is present (Sodian, 1991), to date no study has examined children's verbal deception in the face of physical evidence.

In the present investigation, young children's strategic lie-telling is examined through two experiments. A modified temptation resistance paradigm was used in which children would leave physical evidence if they failed to resist temptation and transgressed. More specifically, children were told not to peek under a cup while the experimenter was out of the room. If a child lifted the cup to peek underneath, candies would spill all over the table, leaving physical evidence of the transgression. Upon returning to the room, the experimenter asked the children whether they had peeked under the cup. If they denied peeking, they were asked to explain why the contents of the cup were scattered on the table.

Experiment 1 assessed whether children between 3 and 5 years of age can tell strategic lies when faced with physical evidence of their transgression. On the basis of the existing findings (Chandler et al., 1989; Lewis et al., 1989; Peskin, 1992; Polak & Harris, 1999; Talwar & Lee, 2002a, 2002b; Talwar, Murphy, & Lee, 2007; Wilson et al., 2003), we expected that most children would lie to deny peeking, as they have done in the previous studies, and that this tendency would increase with age. More importantly, we hypothesized that by requiring children to make their statements consistent with physical evidence of their transgression rather than their initial statement, preschool children should be able to tell strategic lies. Additionally, given that younger children have previously displayed difficulties with producing strategic lies (e.g., Polak & Harris, 1999; Talwar & Lee, 2002a, 2008), an age-related increase in strategic lie-telling abilities was predicted. Because previous findings have demonstrated a relation between children's strategic lies and cognitive skills, in Experiment 2 we examined the cognitive skills related to 4-year-olds' ability to tell strategic lies.

Experiment 1

Method

Participants—Two hundred forty-seven children between 3 and 5 years of age from Beijing, China participated in this study. All children were Han Chinese and were native speakers of Mandarin. Eighty-three children were 3 years old (47 boys, *M* = 42.20 months, *SD* = 2.95), 78 children were 4 years old (36 boys, *M* = 54.20 months, *SD* = 3.11), and 86 children were 5 years old (43 boys, *M* = 66.30 months, *SD* = 3.21). All children were recruited from local preschools and had not yet begun formal schooling. Informed consent was obtained from all parents prior to beginning the study, and oral assent was obtained from all children. According to school records, nearly 50% of the children's parents had at least a college degree, 35% had education from a technical college, and the remaining 15% had a high school or elementary school diploma.

Design and procedure—Children were brought individually to a quiet room in their school with the experimenter. Children were invited to play a guessing game with the experimenter based on a modified temptation resistance paradigm. A single toy or food item (e.g., a toy car, a mini chocolate bar) was hidden under a paper cup that was placed upside down on paper plates, and children were asked to guess what the item was. Children were told, "Do not lift the cup up and peek." With the help of the experimenter, who gave relevant clues, each child successfully guessed the first two items correctly.

On the third trial, children were told by the experimenter, "If you guess this next one correctly, I will give you a present, but if you don't guess correctly, you won't get the present." The experimenter then placed the third cup on the table. Before the child was able to guess the contents of the cup, the experimenter was interrupted and asked to take a phone call. As the experimenter left the room, she asked the child not to move the cup to see the hidden item inside. Prior to the experiment, the third cup had been filled completely with candies and flipped upside down on a paper plate. Thus, if children lifted the cup to see the contents, the candies would fall out of the cup and scatter on the table, leaving physical evidence of their transgression. In addition, pilot testing showed that it was extremely difficult to return the candies and cup to their original position without leaving any evidence (i.e., leaving some candies out on the plate or table). Note that the correct way to do so was to put all the candies in the cup, place the plate over the cup, push the cup and plate tightly together, turn them upside down, and place them on the table swiftly to avoid candy spillage. Given the fact that the entire procedure required high-level handeye coordination, none of the preschoolers were able to return the candies to their original state. After a 1-min delay, the experimenter returned to the room. Children who lifted up the cup were classified as peekers (children who simply touched the cup were not coded as peekers). Interrater reliability for children's peeking was 100%.

If there was no physical evidence that the child had peeked (i.e., no candies on the table), the experimenter asked the child, "While I was gone, did you lift the cup to see what is inside?" If there was evidence that the child had peeked (i.e., candies scattered outside of the cup), the experimenter commented aloud to herself, "How come the candies are outside of the cup?" Then, she asked the child the target question, "While I was gone, did you lift the cup to see what was inside?" If the child said yes, the session was ended. If the child said no, the experimenter asked the follow-up question, "So how did these candies get outside the cup?" Following the child's response to the follow-up question, the session was ended. In response to the target question, children who peeked were classified as initially lying if they told the experimenter that they did not peek under the cup and as confessing if they told the experimenter the truth. None of the children who lied in response to the initial question subsequently confessed during the follow-up question.

The entire session was videotaped with the use of a hidden camera. After the session was completed, all children were individually debriefed about the purpose of the study. Children were also told that the container was designed to spill the candies on the table and that many of the children lifted the cup when the experimenter was away because it was really tempting. Children were debriefed with the use of an Institutional Review Board-approved script. It involved a discussion about truth and lies with the experimenter, and the children were told that some children told a lie about peeking at the candies and others told the truth and that whatever they did that day was okay.

Results

Peeking behavior—Overall, 58% (142) of the children peeked under the cup in the experimenter's absence. Preliminary analyses revealed that there was no significant effect of gender, and the data from both genders were combined for the following analyses. A logistic regression performed with age as the predictor and peeking behavior as the predicted variable (where 1 = peeked, 0 = did not peek) found that as age increased significantly, more children peeked under the cup, $\chi^2(2, N = 142) = 8.47$, $p < .05$, Nagelkerke $R^2 = .05$. A priori contrasts with 4-year-olds (53%) as the reference group showed that 5-year-olds (69.8%) peeked significantly more often than 4-year-olds ($B = .73$, Wald = 5.05, $p < .01$, OR = 2.08). The odds ratio (OR) indicates that for each year increase between 4 and 5 years of age, children were approximately two times more likely to peek. No significant difference was found between 3-year-olds (49%) and 4-year-olds (see Table 1).

Initial lie—Of the 142 children who peeked, 106 (75%) children lied about their transgression in response to the question, "While I was gone, did you move the cup to see what is inside?" whereas only 39 children (25%) confessed. Preliminary analyses revealed that there was no significant effect of gender. However, a logistic regression with age as the predictor and children's lie-telling (where 1 = lie and 0 = truth) as the predicted variable revealed a significant main effect of age, $\chi^2(2, N = 142) = 11.89$, $p < .01$, Nagelkerke $R^2 = 0.12$. A priori contrasts with 4-year-olds as the reference group indicated a marginally significant difference between 4-year-olds (76%) and 3-year-olds (56%) ($B = -.89$, Wald = 3.40, $p = .065$, OR = 2.44). The odds ratio suggests that for each year increase in age, children are almost 2.5 times more likely to tell a lie. No significant difference was found between 4- and 5-year-olds (87%). A post hoc comparison between 3-yearolds and 5-year-olds revealed that 5-year-olds were significantly more likely to lie about peeking compared with 3-year-olds, $t(99) = 3.64$, $p < .05$, $CI_{.95} = -.47, -.14$ (see Table 1). All of the children who refrained from peeking stated that they had not peeked.

Children's response to evidence follow-up question—Of the 106 children who lied about their transgression, 21 children (one 3-year-old, three 4-year-olds, and seventeen 5-year-olds) moved the candies (some children put the candies in a corner of the room or in their pockets, whereas others ate the candies that had fallen out). Because the evidence of peeking was destroyed, the experimenter did not ask these children the follow-up question. Thus, these children were excluded, resulting in a total of 85 children for subsequent analyses.

Children's lies in response to the question about how the candies got outside of the cup were coded into three categories based on the sophistication of the lie. Level 0 included children's lies that were implausible (e.g., "The candies came out themselves" or "I don't know"), and were not considered to be strategic. Responses of "I don't know" were considered to be implausible because the child was alone in the room with the cup, and so she or he must have known what had happened. Level 1 included lies that gave logical explanations as to why the candies were scattered but were unlikely to have occurred (e.g., "Other children came in and knocked over the cup, but you just did not see.”). Level 2 lies were the most sophisticated and included effective strategies to explain away the fact that the candies were outside the cup that were both logical and plausible (e.g., some explanation of unintentionally moving the cup such as, “My elbow knocked over the cup accidentally” or “I just knocked the dish, but the cup fell over.”). All of the Level 2 explanations were found to involve a reference to intentionality. Note that children’s statements were checked against the videotapes and found to be false. Two trained graduate students coded children’s statements with a high reliability of $\alpha = .91$.

Preliminary analyses revealed that gender was not significantly related to lie-telling ability and thus was not included in the following analyses. A multinomial logistic regression was performed to assess the relation between age and the three levels of lies, with the former as the predictor and the latter as the predicted variable. Age significantly predicted the sophistication level of lies, $\chi^2(4, N = 85) = 32.94$, $p < .05$, Nagelkerke $R^2 = 0.36$. A priori contrasts with 4-year-olds as the reference for the predictor variable and Level 2 lies as the reference for the predicted variable revealed that significantly more 4-year-olds told Level 0 lies than Level 2 lies compared with 5-year-olds ($B = -1.99$, Wald = 7.82, $p < .05$), with 4-year-olds being almost three times more likely to tell a Level 0 lie compared with 5-year-olds. Additionally, significantly more 4-year-olds told Level 1 lies than Level 2 lies compared with 5-year-olds ($B = -1.67$, Wald = 6.31, $p < .05$, OR = 5.26), with the odds ratio indicating that 4-year-olds were more than five times more likely to tell a Level 0 lie compared with 5-year-olds. No significant differences were found between 3-year-olds and 4-year-olds (see Figure 1).

Discussion

Overall, approximately half (58%) the children transgressed and peeked under the cup while the experimenter was gone. As age increased, children were significantly more likely to lift the cup to peek, with 4- and 5-year-olds peeking more often than 3-year-olds. Previous temptation resistance paradigms have typically found no age differences in peeking behavior (e.g., Talwar & Lee, 2002a, 2008). However, the methods used in previous studies have typically asked children not to look at a toy, whereas in the present investigation children were asked not to lift the cup. Polak and Harris (1999) demonstrated significant differences in children’s peeking behaviors when children were asked not to look at (95% of children peeked) compared with touch a toy (only 54% of children touched). Thus, the specific actions of rule violation that children need to perform seem to have an impact on their peeking behavior. However, the exact reasons underlying this difference in peeking between the different acts of rule violation and the related age difference found in the present experiment are not clear. Because the focus of the present study was on children’s lie-telling behaviors rather than on their rule violation, the issue was not further examined, which requires specifically designed studies to explore.

Consistent with previous findings, children’s lie-telling behavior increased with age: Whereas only half (56%) of 3-year-olds who transgressed lied, the majority of older children (76% and 87% of 4- and 5-year-olds, respectively) lied to conceal their transgression (Lewis et al., 1989; Polak & Harris, 1999; Talwar & Lee, 2002a, 2008). Thus, consistent with Darwin’s early observation, young children will lie in an attempt to conceal their transgression.

Furthermore, the sophistication of children’s lies increased with age. Specifically, whereas few 3-year-olds were capable of telling a strategic lie to be consistent with the physical evidence, about half the 4-year-olds and the majority of the 5-year-olds did so. Thus, consistent with our original hypothesis, young children were able to tell a strategic lie by making a false statement consistent with the physical evidence of their transgression.

Experiment 2

Our first experiment revealed that even young children were able to tell a strategic lie. The question remains as to the factors that may have enabled children to tell strategic lies. On the basis of existing experimental research, there are two factors that may significantly influence children's ability to tell strategic lies: children's theory-of-mind (ToM) understanding and executive functioning (EF) skills (Carlson & Moses, 2001; Chandler et al., 1989; Polak & Harris, 1999; Talwar & Lee, 2008).

ToM

ToM can be described as an understanding that people are mental beings and that their actions can be interpreted or explained on the basis of our mental states such as beliefs, desires, and intentions (Milligan, Astington, & Dack, 2007). One of the hallmarks of ToM understanding is the ability to understand that people may have false beliefs that differ from the true state of affairs. Extensive evidence indicates that there is a dramatic shift in children's false-belief understanding between 3 and 6 years of age (Milligan et al., 2007; Wellman, Cross, & Watson, 2001), which parallels the development of children's lie telling (Talwar & Lee, 2008). Researchers have hypothesized that there is a close relation between children's false-belief understanding and their lie-telling behaviors (Chandler et al., 1989; Polak & Harris, 1999). Specifically, in order to tell a lie successfully, one must deliberately create a false belief in the mind of a listener. Thus, children must have an understanding that another person's belief may differ from their own and that they can manipulate another's belief in order to tell a lie.

Previous research has revealed that the development of deceptive behavior, such as lying, during the preschool years is paralleled by the significant development in children's false-belief understanding (Chandler et al., 1989; Hala, Hug, & Henderson, 2003; Peskin, 1992; Ruffman, Olson, Ash, & Keenan, 1993; Sodian, 1991). Further developing this relation, Polak and Harris (1999) and Talwar and Lee (2008) both found that young children's first-order ToM understanding was related to their false denials of a transgression. Although neither Talwar and Lee (2008) nor Talwar, Gordon, and Lee (2007) found that second-order ToM understanding was related to whether children would feign ignorance to the identity of the peeked-at item, it was related to their explanations of their knowledge. In particular, second-order ToM understanding was found to be related to children's ability to provide plausible explanations for their knowledge of the identity of a peeked-at item (Talwar & Lee, 2008; but see also Talwar, Gordon, & Lee, 2007) and whether children would feign ignorance to additional features of the peeked-at item such as the color of the ink (Talwar, Gordon, & Lee, 2007).

In the present study, in an attempt to reduce second-order ToMrequirements, children were no longer required to reason about what the adult would be able to infer on the basis of the knowledge revealed from what children claimed previously. Rather, children were only required to reason about the false belief they needed to instill in the mind of the lie recipient given the present physical evidence. In other words, first-order ToM understanding may be sufficient for children to strategically lie.

EF

EF skills have been defined as higher order psychological processes involved in goal-oriented behavior under conscious control (Zelazo & Muller, 2002). A number of cognitive skills, such as inhibitory control, planning, cognitive flexibility, and working memory, are included in EF skills (Welsh, Pennington, & Groisser, 1991; Zelazo, Carter, Reznick, & Frye, 1997). As with ToM development, there is a sharp increase in children's EF skills during the preschool years (Zelazo & Muller, 2002), again coinciding with the development of lie telling. Two specific hypotheses were made in regard to the relation between children's strategic lying and two specific EF skills.

First, we hypothesized that inhibitory control, or an individual's ability to suppress a response or behavior while completing a separate goal, is required to tell strategic lies, as one must inhibit the truth (e.g., reporting they peeked under the cup) while reporting false information. One study, conducted by Carlson, Moses, and Hix (1998), found that children who demonstrated difficulty with inhibitory control had difficulty deceiving someone by pointing to the wrong location of an object. More recently, Talwar and Lee (2008) built on Carlson et al.'s findings by assessing children's verbal lie-telling behaviors and found that children's ability to deny their transgression, but not their ability to maintain consistency between their initial lie and their other verbal statements, was related to their inhibitory control skills. The present experiment aimed to assess the relation between inhibitory control skills and children's strategic lie-telling behaviors when physical evidence of their transgression was present. To this end, a number of inhibitory control measures were used in the present study, including Day/Night Stroop, Bear/Dragon, Dimensional-Change Card Sort, Tower Building, KRISP, and Gift Delay tasks (Sabbagh, Xu, Carlson, Moses, & Lee, 2006).

The second EF skill, which we hypothesized related to children's strategic lie telling, was planning ability. In order to successfully tell a strategic lie, one must create a plan of deception by organizing their statements in a fashion that will successfully conceal their transgression. Without the ability to plan what one is going to say or do, it would be difficult to successfully tell a lie consistent with either existing physical evidence or verbal evidence. The Motor Sequencing task was used in this experiment as a planning measure. We hypothesized that children with higher planning scores would be better able to successfully tell strategic lies, as they would be able to plan what they would have to say to be consistent with the physical evidence of transgression in front of them.

To assess whether individual differences in children's sociocognitive skills were related to their strategic lie-telling abilities, we specifically focused on 4-year-old children in this experiment because Experiment 1 demonstrated that most of the 3-year-olds showed limited use of strategic lying, and most of the 5-year-olds tended to tell the most sophisticated level of lies. In contrast, the 4-year-olds in Experiment 1 were most variable in their use of strategies, creating an ideal situation to test the relation between strategic lying, EF, and ToM abilities.

Method

Participants—Two hundred fifty-two 4-year-olds from Beijing, China participated in this study. All children were Han Chinese and were native speakers of Mandarin. Seven children were unable to complete all sessions due to either illness or moving schools and thus were excluded. A total of two hundred forty-five 4-year-old children completed all sessions (127 boys, M = 54.0 months, SD = 3.37, range = 48–59 months). None of these children had previously participated in Experiment 1. All children were recruited from local preschools and had not yet begun formal schooling. Informed consent was obtained from all parents prior to beginning the study, and verbal assent was obtained from all children. According to school records, nearly 50% of the children's parents had at least a college degree, 35% had education from a technical college, and the remaining 15% had a high school or elementary school diploma.

Procedure—All children completed a series of tasks, as outlined below, across three sessions. All children were individually tested in a quiet room within their school.

The verbal ability task—Children's verbal ability was assessed using the Core Vocabulary scale of the Wechsler Preschool and Primary Scale of Intelligence–Revised (WPPSI; Wechsler, 1989) in Mandarin, normed on Mainland Chinese samples. The total score of this subscale ranged from 0 to 44.

EF measures—The EF battery was based on Carlson and Moses (2001) and Sabbagh et al. (2006).

Inhibitory control measures: A series of inhibitory control measures were administered. In all inhibitory control tasks, children were required to respond counter to a prepotent response.

Day/night stroop: Children were shown 16 cards sequentially with either a sun or a moon on them. Children were instructed to say "day" when they saw a picture of a moon and "night" when they saw a picture of a sun. All children received a proportion correct score between zero and one (Gerstadt, Hong, & Diamond, 1994).

Bear/dragon: For the Bear/Dragon task, a panda bear and lion puppet were used due to positive cultural associations with dragons. Children were asked to do what the panda said (e.g., "touch your leg") but not what the mean lion said. Children were scored on their performance to inhibit behaviors on the five lion trials. For each trial, children were assigned a score of 0–3 for the extent of compliance, with higher scores indicating more compliance. Total scores ranged from 0 to 15 (Reed, Pien, & Rothbart, 1984), with an interrater reliability of 99% agreement.

Dimensional-change card sort (DCCS): Children were instructed to sort cards that varied on two dimensions, shape and color. First, children were asked to sort according to one dimension (e.g., shape). Then children were asked to sort by the other dimension (e.g., color). Children were given one point for each of the correct postswitch sorts (i.e., on the second dimension). Total scores for this task ranged from 0 to 3 (Frye, Zelazo, & Palfai, 1995). This task has been suggested to measure children's inhibitory control skills and cognitive flexibility (Carlson & Moses, 2001; Zelazo, 2006).

Tower building: Children were asked to help the experimenter build a tower with wooden blocks. The experimenter and child alternated turns placing the blocks. Across two trials, the child was scored on the average proportion of blocks placed by the experimenter. Total scores ranged from 0 to 50 (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996).

Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP): Children received 10 trials in which they were shown a target picture and asked to identify an exact match from a series of four to six similar pictures. There are 10 trials in this task. The total score for this task is the number of correct responses, ranging from 0 to 10 (Wright, 1971).

Gift delay: During the gift delay task, children were asked to sit in their chair with their back to the experimenter and wait for a "big surprise" gift. Children were asked not to turn around while the experimenter noisily wrapped the gift. The amount of time it took for each child to turn around and peek at the gift was recorded as their inhibitory control score (Kochanska et al., 1996).

Planning abilities—The planning measure used for this experiment assessed both children's motor speed and planning abilities but did not require inhibitory control skills (Carlson & Moses, 2001).

Motor sequencing: The motor sequencing task was modified fromWelsh et al. (1991). Children were shown a musical keyboard with four differently colored keys. Children were shown a specific sequence and practiced until they got two consecutive trials correct. Children were then instructed to play the sequence over and over again as fast as they could until the experimenter said stop. The number of sequences they correctly completed within 10 s was scored.

ToM measures

Mistaken location: For the mistaken location task, children were read two scenarios. First, children watched a puppet show in which a puppet placed a ball in one location and left. While he was gone, the ball was moved. Children were then asked where the puppet *thought* the ball was (Wimmer & Perner, 1983). In the second scenario, children were told that a boy *thought* his cat was in one location (under his bed), but it was *really* somewhere else (in the cupboard). Children were then asked where the boy would look for his cat (Wellman & Bartsch, 1988). Children were given 1 point for answering each question correctly. The total scores for each of the scenarios (ranging from 0 to 2) were summed to create a total mistaken locations score out of 4.

Mistaken contents: For the mistaken contents task, children were shown a familiar box and asked what they thought was inside. Children were then shown that the box contained something other than what the box suggested. Each child was then asked (a) what they had originally thought was inside the box before it had been opened, (b) what someone else who had not seen inside the box would think was inside, and (c) what was really inside the box (Gopnik & Astington, 1988). Children received 1 point for each question they correctly answered. Total mistaken contents scores ranged from 0 to 3.

Total overall scores for the Theory of Mind battery ranged from 0 to 7 (see Table 2 for means and standard deviations and Tables 3 and 4 for correlation matrixes with EF tasks). Previous studies examining cross-cultural differences in ToM understanding have found no developmental differences in this age range between Chinese and North American children (Sabbagh et al., 2006).

Temptation resistance procedure—The materials and procedures for this task were exactly the same as that used in Experiment 1.

Order of tasks—Tasks were divided across three sessions with a week delay in between, and the order of sessions was randomized between participants. The sessions were divided as follows: (a) the WPPSI vocabulary subscale (following the standard WPPSI procedure); (b) EF tasks, in which the task order was fixed in the order of Day/Night, Bear/Dragon, DCCS, Tower- Building Task, KRISP, Motor Sequence, and Gift Delay (Carlson & Moses, 2001); and (3) three ToM tasks and the temptation resistance procedure, with the temptation resistance procedure always occurring last (see Table 5 for a list of all the tasks). Each session lasted approximately 20–30 min.

Results

Peeking behavior and its relation to sociocognitive factors—Overall, 59% of children (144) peeked under the cup in the experimenter's absence. Consistent with our findings in Experiment 1, nearly half the 4-year-olds transgressed and peeked under the cup. Preliminary analyses revealed no significant effects of age (in months) or gender. Thus, age and gender were not included in the remaining analyses on children's peeking behavior (see Table 1).

Because each EF task's scoring standards were different, we performed a *z*-score transformation on all EF measures according to Sabbagh et al.'s (2006) method. The total EF score for each participant was the summed *z* scores of all the EF tasks. Cross-cultural differences between China and the United States have been previously found in the development of young children's EF scores, with Chinese children performing on par with U.S. children who were 6 months older (Sabbagh et al., 2006). EF scores of Chinese children in the present study fall within the normal range for Chinese children (see Table 2 for the means of each task and Tables 3 and 4 for correlation matrixes between all tasks).

We performed a logistic regression on children's peeking behavior (where 0 = *nonpeeker* and 1 = *peeker*), with verbal ability (WPPSI) entered on the first step and ToM performance and EF total score entered on the second step. The first model including verbal ability was not significant (Nagelkerke $R^2 = 0.01$), $\chi^2(1, N = 144) = 0.56$, $p > .05$. After controlling for verbal ability, the second model with ToM and total EF scores were also not significant (Nagelkerke $R^2 = 0.01$), $\chi^2(2, N = 144) = 1.12$, $p > .05$. Thus, consistent with previous findings (Talwar & Lee, 2008), children's peeking behavior does not appear to be related to their EF or ToM scores.

Initial lies and their relation to sociocognitive factors—Of the 144 children who peeked, 100 (69.4%) children lied about their transgression in response to the question, "While I was gone, did you move the cup to see what is inside?" and only 44 (30.6%) children confessed. Preliminary analyses revealed that gender was not significantly related to children's initial lies. Thus, gender was not included in the following analyses on children's initial lies.

To examine the influence of sociocognitive factors on children's initial lie-telling behaviors, we performed a logistic regression on lie-telling behavior (where 0 = *truth* and 1 = *lie*) with age in months entered on the first step, verbal ability on the second step, and children's total ToM and total EF scores on the final step. The first model with age was significant (Nagelkerke $R^2 = .05$), $\chi^2(1, N = 100) = 5.08$, $p < .05$. As age increased, children were significantly more likely to lie about their transgression ($B = .12$, Wald = 4.92, $p < .05$). However, neither the second nor third blocks were significant (Nagelkerke $R^2_{block2} = 0.05$), $\chi^2(2, N = 100) = 5.54$, $p <= .06$; (Nagelkerke $R^2_{block3} = 0.07$), $\chi^2(2, N = 100) = 2.00$, $p = .11$. Hence, children's lie-telling behaviors appeared to increase with age.

Sophistication of lies and its relation to sociocognitive factors—Of the children who lied, seven children removed the evidence (mean age = 54.43 months, *SD* = 1.81, one boy). Thus, the experimenter did not see the evidence and was unable to ask the follow-up questions. As such, these children were not included in the subsequent analyses. No significant differences between children who removed the evidence and the remainder of participants were found in age, verbal ability, ToM performance, or any of the EF tasks. However, given the small number of participants who removed the evidence, it is not surprising that no significant differences were found (see Table 2 for means and standard deviations).

As in Experiment 1, two master's-level graduate students coded children's response to the question of how the candies got outside of the cup into three levels of sophistication. Reliability between the two coders was high ($\alpha = .89$).

Overall, 41% ($N = 38$) of children told Level 0 lies, 38% ($N = 35$) of children told Level 1 lies, and 21% ($N = 20$) of children told Level 2 lies. We performed a multinomial regression analysis with sophistication of lies as the predicted variable and age and gender entered on the first step. The model was not significant (Nagelkerke $R^2 = .03$), $\chi^2(4, N = 100) = 2.23$, *p*

> .05, indicating that neither age in months nor gender significantly predicted strategic lie-telling abilities: age, $\chi^2(2, N = 100) = 1.48$, $p > .05$; gender, $\chi^2(2, N = 100) = 0.74$, $p > .05$ (see Table 1). The lack of a significant age effect was likely due to the fact that we limited the participants to 4 years of age. Because age and gender were not significant, they were not included in the remaining analyses.

Using the three categories of children's lies as the predicted variable, we performed a multinomial logistic regression to assess the sociocognitive factors that may be related to the sophistication of children's lies. We entered verbal ability, ToM scores, and total EF scores in the model on the first step. The model was significant (Nagelkerke $R^2 = .27$), $\chi^2(6, N = 100) = 24.75$, $p < .01$. Children's verbal ability did not significantly predict their lie-telling ability above and beyond the other variables in the model, $\chi^2(2, N = 100) = 2.11$, $p > .05$. However, both children's total EF score and ToM score significantly predicted their lie-telling ability, $\chi^2(2, N = 100) = 6.25$, $p < .05$; and, $\chi^2(2, N = 100) = 8.25$, $p < .05$, respectively. A priori contrasts with Level 0 lies as the reference group for the predicted variable revealed that children with higher ToM scores are significantly more likely to tell Level 1 ($B = .49$, Wald = 4.99, $p < .05$, OR = 1.63) and Level 2 lies ($B = .68$, Wald = 5.43, $p < .05$, OR = 1.97). Additionally, children with higher EF scores were significantly more likely to tell Level 2 lies than Level 0 lies ($B = .87$, Wald = 5.17, $p < .05$, OR = 2.40), and no significant difference was revealed between Level 1 and Level 0 lies. The odds ratio suggests that with a 1-point increase in ToM scores, children were 1.63 times more likely to tell a Level 1 lie and 1.97 times more likely to tell a Level 2 lie compared with a Level 0 lie. Furthermore, a 1-point increase in EF scores doubles the odds of children telling a Level 2 lie compared with a Level 1 lie.

To assess which EF measures were contributing uniquely to the sophistication of children's strategic lies, we performed a second multinomial logistic regression on children's lie-telling ability. Because verbal ability was not a significant predictor in the previous regression, we excluded it for the purpose of this analysis. We entered ToM and the *z* scores for each of the seven individual EF scores (Day/Night Stroop, DCCS, KRISP, Bear/Dragon, Tower Building, Motor Sequence, and Gift Delay) into the model on the first step. The model was significant (Nagelkerke $R^2 = 0.40$), $\chi^2(16, N = 100) = 40.10$, $p < .01$. We performed a priori contrasts by using Level 0 lies as the reference group. Above and beyond the common contributions of all predictor variables, children with higher ToM scores were significantly more likely to tell Level 1 lies ($B = .70$, Wald = 7.11, $p < .05$, OR = 2.01) and were marginally more likely to tell Level 2 lies ($B = .54$, Wald = 3.02, $p = .08$, OR = 1.71) than Level 0 lies. Additionally, children who had higher Day/Night scores were more likely to tell Level 2 lies than Level 0 lies ($B = 1.87$, Wald = .95, $p = .048$, OR = 6.51). The odds ratios suggest that for each point increase in children's ToM score, they were two times more likely to tell a Level l lie and more than 1.71 times more likely to tell a Level 2 compared with a Level 0 lie. Furthermore, for each point increase in Day/Night scores, children were more than six times more likely to tell a Level 2 lie compared with a Level 0 lie.

Discussion

In summary, the present experiment revealed that the sophistication of children's lies was significantly related to both their EF and ToM scores. Furthermore, above and beyond the common contributions shared by the two sets of social-cognitive measures, children's ToM scores and inhibitory control skills further uniquely accounted for the sophistication of their lies (see the General Discussion section for further discussion).

However, neither children's peeking nor their initial lie-telling behaviors were significantly related to their executive functioning scores. Furthermore, in contrast to Talwar and Lee

(2008) and Polak and Harris' (1999) findings, no significant relation was found between children's initial lie-telling behaviors and the sociocognitive factors. Talwar and Lee (2008) found that first-order ToM understanding and inhibitory control skills were both significantly related to whether children would lie about their transgression. In addition, Polak and Harris found that first-order ToM skills were related to whether children would tell a lie. Overall, in the present study, the ToM scores for children who peeked ranged from 2 to 7 ($M = 5.47$, $SD = 1.34$), suggesting that children did not perform at ceiling on the task and had reasonable variability in their scores to possibly find a relation with lie telling. One possible explanation for the difference in findings between the present investigation and previous studies is that the nature of the tasks was different. In the present study, children with superior ToM skills might have been better able to infer that because the candies were outside of the cup, the experimenter would know that they had peeked regardless of what they had said. Hence, ToM understanding may have deterred some children from lying, as well as assisting those children who told lies in creating sophisticated strategic lies. Given that ToM understanding may discourage some children from lying while at the same time assisting others in telling sophisticated lies, the present paradigm may not have been able to find a straightforward positive correlation between ToM understanding and lie telling. These results suggest that perhaps the relation between ToM understanding and lie telling is situation dependent.

General Discussion

In the present set of studies, we investigated whether young children are capable of telling a lie strategically by making it consistent with the physical evidence of their transgression and the sociocognitive correlates of such lie-telling behaviors. The results of Experiment 1 were consistent with existing findings that with increased age, children are significantly more likely to tell a lie.

With regards to children's ability to tell strategic lies, some evidence suggested that preschool children were incapable of telling strategic lies and that the ability to do so was related to second-order ToM abilities (Polak & Harris, 1999; Talwar & Lee, 2008). However, the results of Experiment 1 demonstrate that young children have the ability to tell strategic lies to be consistent with the physical evidence by about 4 or 5 years of age, and this ability increases in sophistication with age.

We then identified two factors related to children's ability to tell strategic lies in Experiment 2. Consistent with the general consensus that successful lie telling requires ToM understanding, we found that children's first-order ToM understanding was positively related to their ability to tell strategic lies. However, previous studies (Polak & Harris, 1999; Talwar & Lee, 2008) have found that the sophistication of children's lies is not related to first-order ToM understanding, but rather second-order ToM understanding.

One possible reason for this differential finding is the reasoning that is required for the situation in the tradition paradigm and the present paradigm. In the traditional temptation resistance paradigm used by Talwar and Lee (2008) and Polak and Harris (1999), children are required to think recursively about what response they could construct that the lie recipient would interpret as the child guessing rather than actually knowing the identity of the toy. In contrast, in the temptation resistance paradigm used in the present study, in order to make an explanation that is both logical and plausible (Level 2 lie; e.g., knocking over the cup by accident), children only needed to make a distinction between intentional behaviors (transgressions) versus accidental behaviors to tell a strategic lie. In other words, children in our paradigm were required to reason about intentions, whereas children in the traditional paradigm were required to reason about beliefs. Researchers have suggested that children's understanding of intentions develops prior to their understanding of others' mental states, such as beliefs (Baird & Astington, 2005; Wellman & Phillips, 2003; see also Bartsch & Wellman, 1995). Thus, the simpler form of mentalistic reasoning in the present study may have resulted in a relation of lying with first- rather than second-order ToM understanding, and specifically a unique contribution of the ToM measures to children's sophistication of lying above and beyond the measures' shared contributions with other sociocognitive measures.

Another possible explanation for why the young children in the present investigation were able to tell strategic lies is the fact that children were required to lie about the action of the transgression rather than acquired knowledge from the transgression. In previous studies using the temptation resistance paradigm, children were required to deny knowledge (the identity of the toy) that they gained through the prohibited action (touching or peeking). However, in the present studies' paradigm, children simply had to lie about the prohibited action itself. Thus, children were only required to lie about a feature of the action itself rather than about a consequence of the action. This more simplistic form of reasoning in general may have reduced the cognitive demands on young children and thus allowed them to demonstrate an ability to tell such strategic lies.

The second factor that was found to be related to children's strategic lies was children's EF scores, supporting our original hypothesis. Interestingly, although the executive functioning measures together significantly predicted the sophistication of children's lies, only the Day/Night Stroop inhibitory control measure had a significant unique contribution. This finding is consistent with Talwar and Lee (2008), who also found that children's Stroop scores significantly predicted lie-telling behaviors, whereas no other inhibitory control skills were significantly uniquely related. Unlike the other inhibitory control measures in these studies, the Stroop task is thought to measure both inhibitory control and working memory. Thus, it may be that working memory in conjunction with inhibitory control plays an important role in children's strategic lying. In the present situation, children were required to hold in working memory what they did (i.e., peeked under the cup), while creating a false statement that did not reveal their transgression that must be consistent with the physical evidence. In addition, they must simultaneously inhibit reporting the truth. Future studies isolating the unique contribution of working memory and inhibitory control skills are required to gain a greater understanding of this relation.

One surprising finding of the present study was that children's planning skills were not significantly uniquely related to their lie-telling abilities. One possible explanation for this result may be that we did not give children enough time to plan and develop their lies. Perhaps if we had given children a longer delay before entering the room or even allowed children to come get the experimenter when they were ready, we might have found a significant relation between children's planning scores and their lie-telling abilities. It is also possible that a relation with planning skills may be found with those children who originally deceived the experimenter by hiding or disposing of the evidence prior to the experimenter returning to the room, an issue requiring further investigation. Another possible explanation is that although children's planning abilities were assessed, the task used measured a motor sequencing form of planning rather than a logic style of planning required for successful deception. Perhaps using a different measure such as the Tower of London would result in a significant relation between children's lie-telling behaviors and planning abilities. Future studies are needed to further assess these possibilities.

The present investigation demonstrated that both ToM understanding and executive functioning skills were related to the sophistication of children's lies, but neither of these skills was related to whether children told a lie to deny their transgression. One possible reason for these findings is that providing an explanation for how the candies ended up on the table requires children to make counterfactual inferences about a longer causal chain than simply denying their transgression. Counterfactual thinking requires children to think about situations that might have happened, but in reality did not (German & Nichols, 2003). German and Nichols (2003) found that although 3-year-olds were able to reason about short causal chains, it was not until 4 years of age that children were able to reason about longer causal chains. In the present study, children simply had to state the opposite of reality when making their initial lie ("No, I did not lift the cup"). However, when providing an explanation for how the candies ended up on the table, children had to not only deny having touched the cup but also provide a plausible explanation for how the candies ended up on the table. Although the first task of simply denying the transgression involves a more simple causal chain (easily performed by 3-year-olds), the explanation of "how" the candies ended up on the table is a much more difficult causal chain. A promising future study is to investigate whether children's ability to carry out counterfactual thinking about long and short causal chains is related to their strategic lying ability.

Another intriguing finding of the present investigation was children's deceptive behavior of concealing their transgression by removing the candies. In Experiment 1, the frequency with which children used this method to conceal their transgression appeared to increase with age (one 3-year-old, three 4-year-olds, and seventeen 5-year-olds). Unfortunately, due to the small number of children who chose to conceal their transgression in this manner, we were unable to analyze these findings. Experiment 2, although only conducted with 4-year-olds, suggests that there were no cognitive differences between children who concealed their transgression by removing the candies and those who did not. Future studies specifically designed to examine this behavior are required to address whether there are potentially developmental or cognitive differences between children who decide to conceal their transgression by removing the evidence and those who do not.

Although previous studies have found significant cross-cultural differences between Chinese and North American children's evaluation of lies for modesty purposes (to conceal one's own good deeds) or to help a collective, no cross-cultural differences have been found in children's evaluations of antisocial lies (Fu et al., 2008; Fu, Lee, Cameron, & Xu, 2001; Fu, Xu, Cameron, Heyman, & Lee, 2007; Lee, Xu, Fu, Cameron, & Chen, 2001). However, cross-cultural differences have been found in children's performance on executive functioning skills. Specifically,Sabbagh et al. (2006) found that Chinese children were approximately 6 months ahead of American children in their EF performance. In addition, Oh and Lewis (2008) found that Korean children passed executive functioning tasks at 2 years of age that European children did not pass until 4 years of age. Given that children's strategic lie telling is related to their executive functioning skills, there may be developmental differences across cultures. Specifically, Korean children may tell lies strategically earlier than Chinese children, whereas American children may tell strategic lies later. However, this speculation needs to be confirmed through an empirical investigation.

In summary, our findings appear to support Darwin's early observations. Indeed, when young children transgress and leave evidence behind, they are motivated to tell lies to conceal their transgression. Also consistent with Darwin's early observation of his 2-year-old son, 3-year-olds were not successful at telling strategic lies. The present investigation suggests that a lack of inhibitory control and ToM understanding may play an important role in young children's difficulty in telling strategic lies. Such ability only begins to emerge around 4 years of age when children's ToM understanding and executive functioning abilities have reached some form of maturity.

Acknowledgments

This research was supported by the National Institutes of Health Grants NIH R01 HD048962 and HD HD047290 and the Social Sciences and Humanities Research Council of Canada.

References

Baird, JA.; Astington, JW. The development of intention concept: From the observable world to the unobservable mind. In: Hassin, RR.; Uleman, JS.; Bargh, JA., editors. The new unconscious. New York, NY: Oxford University Press; 2005. p. 256-276.

Bartsch, K.; Wellman, HM. Children talk about the mind. New York, NY: Oxford University Press; 1995.

Carlson SM, Moses LJ. Individual differences in inhibitory control and children's theory of mind. Child Development. 2001; 72:1032–1053. [PubMed: 11480933]

Carlson SM, Moses LJ, Hix HR. The role of inhibitory processes in young children's difficulties with deception and false belief. Child Development. 1998; 69:672–691. [PubMed: 9680679]

Chagoya L, Schkolne T. Children who lie: A review of literature. Canadian Journal of Psychiatry. 1986; 31:665–669.

Chandler MJ, Fritz AS, Hala SM. Small-scale deceit: Deception as a marker of two-, three-, and four-year-olds' early theories of mind. Child Development. 1989; 60:1263–1277. [PubMed: 2612240]

Darwin C. A biographical sketch of an infant. Mind. 1877; 2:285–294.

Frye D, Zelazo PD, Palfai T. Theory of mind and rule-based reasoning. Cognitive Development. 1995; 10:483–527.

Fu G, Evans AD, Wang L, Lee K. Lying in the name of the collective good: A developmental study. Developmental Science. 2008; 11:495–503. [PubMed: 18576957]

Fu G, Lee K, Cameron CA, Xu F. Chinese and Canadian adults' categorization and evaluation of lie- and truth-telling and prosocial and antisocial behaviors. Journal of Cross-Cultural Psychology. 2001; 32:720–727.

Fu G, Xu F, Cameron CA, Heyman G, Lee K. Crosscultural differences in children's choices, categorization, and evaluation of truths and lies. Developmental Psychology. 2007; 43:278–293. [PubMed: 17352539]

German TP, Nichols S. Children's counterfactual inferences about long and short causal chains. Developmental Science. 2003; 6:514–523.

Gerstadt CL, Hong YJ, Diamond A. The relationship between cognition and action: Performance of children 3 1/2–7 years old on a Stroop-like day-night test. Cognition. 1994; 53:129–153. [PubMed: 7805351]

Goodman GS, Myers JEB, Qin J, Quas JA, Castelli P, Redlich AD, Rogers L. Hearsay versus children's testimony: Effects of truthful and deceptive statements on juror's decisions. Law and Human Behavior. 2006; 30:363–401. [PubMed: 16779675]

Gopnik A, Astington JW. Children's understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction. Child Development. 1988; 59:26–37. [PubMed: 3342716]

Hala S, Hug S, Henderson A. Executive functioning and theory of mind in preschool children: Two tasks are harder than one. Journal of Cognition and Development. 2003; 4:275–298.

Hartshorne, H.; May, MA. Studies in deceit. Book I. General methods and results. Book II. Statistical methods and results. Oxford, England: MacMillan; 1928.

Heyman G, Luua D, Lee K. Parenting by lying. Journal of Moral Education. 2009; 38:353–369. [PubMed: 20930948]

Kochanska G, Murray K, Jacques TY, Koenig AL, Vandegeest KA. Inhibitory control in young children and its role in emerging internalization. Child Development. 1996; 67:490–507. [PubMed: 8625724]

Lee, K. The development of lying: How children do deceptive things with words. In: Astington, JW., editor. Minds in the making. Oxford, England: Blackwell; 2000. p. 177-196.

Lee, K.; Evans, AD. Development of social pragmatics of deceptive communication. In: Matsui, T., editor. Pragmatics and theory of mind. New York, NY: John Benjamins; (in press).

Lee K, Xu F, Fu G, Cameron CA, Chen S. Taiwan and Mainland Chinese and Canadian children's categorization and evaluation of lie- and truth-telling: A modesty effect. British Journal of Developmental Psychology. 2001; 19:525–542.

Lewis, M. The development of deception. In: Lewis, M.; Saarni, C., editors. Lying and deception in everyday life. New York, NY: Guilford Press; 1993. p. 90-105.

Lewis M, Stanger C, Sullivan M. Deception in 3-year-olds. Developmental Psychology. 1989; 25:439–443.

Lyon TD. Child witnesses and the oath: Empirical evidence. Southern California Law Review. 2000; 73:1017–1074.

Milligan K, Astington JW, Dack L. Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. Child Development. 2007; 78:622–646. [PubMed: 17381794]

Oh S, Lewis C. Korean preschoolers' advanced inhibitory control and its relation to other executive skills and mental state understanding. Child Development. 2008; 79:80–99. [PubMed: 18269510]

Peskin J. Ruse and representations: On children's ability to conceal information. Developmental Psychology. 1992; 28:84–89.

Polak A, Harris PL. Deception by young children following noncompliance. Developmental Psychology. 1999; 35:561–568. [PubMed: 10082026]

Reed M, Pien DL, Rothbart MK. Inhibitory self-control in preschool children. Merrill-Palmer Quarterly. 1984; 30:131–147.

Ruffman T, Olson DR, Ash T, Keenan T. The ABC's of deception: Do young children understand deception in the same way as adults? Developmental Psychology. 1993; 29:74–87.

Sabbagh MA, Xu F, Carlson SM, Moses LJ, Lee K. The development of executive functioning and theory of mind: A comparison of Chinese and US preschoolers. Psychological Science. 2006; 17:74–81. [PubMed: 16371147]

Sodian B. The development of deception in young children. British Journal of Developmental Psychology. 1991; 9:173–188.

Stouthamer-Loeber M. Lying as a problem behavior in children: A review. Clinical Psychology Review. 1986; 6:267–289.

Strichartz AF, Burton RV. Lies and truth: A study of the development of the concept. Child Development. 1990; 61:211–220. [PubMed: 2307041]

Talwar V, Gordon H, Lee K. Lying in the elementary school: Verbal deception and its relation to second-order belief understanding. Developmental Psychology. 2007; 43:804–810. [PubMed: 17484589]

Talwar V, Lee K. Development of lying to conceal a transgression: Children's control of expressive behavior during verbal deception. International Journal of Behavioral Development. 2002a; 26:436–444.

Talwar V, Lee K. Emergence of white lie-telling in children between 3 and 7 years of age. Merrill-Palmer Quarterly. 2002b; 48:160–181.

Talwar V, Lee K. Social and cognitive correlates of children's lying behavior. Child Development. 2008; 79:866–881. [PubMed: 18717895]

Talwar V, Lee K, Bala N, Lindsay RCL. Children's conceptual knowledge of lie-telling and its relation to their actual behaviors: Implications for court competence examination. Law and Human Behavior. 2002; 26:395–415. [PubMed: 12182530]

Talwar V, Lee K, Bala N, Lindsay RCL. Children's lie-telling to conceal a parent's transgression: Legal implications. Law and Human Behavior. 2004; 28:411–435. [PubMed: 15499823]

Talwar V, Murphy S, Lee K. White lie-telling in children for politeness purposes. International Journal of Behavioral Development. 2007; 31:1–11. [PubMed: 18997880]

Wechsler, D. WPPSI–R manual: Wechsler Preschool and Primary Scale of Intelligence–Revised. New York, NY: Psychological Corporation; 1989.

Wellman HM, Bartsch K. Young children's reasoning about beliefs. Cognition. 1988; 30:239–277. [PubMed: 3215003]

Wellman HM, Cross D, Watson J. Meta-analysis of theory-of-mind development: The truth about false belief. Child Development. 2001; 3:655–684. [PubMed: 11405571]

Wellman, HM.; Phillips, AT. Developing intentional understanding. In: Malle, BF.; Moses, LJ.; Baldwin, DA., editors. Intentions and intentionality foundations of social congnition. Cambridge, MA: MIT Press; 2003. p. 125-148.

Welsh MC, Pennington BF, Groisser DB. A normative-developmental study of executive function: A window on prefrontal function in children. Developmental Neuropsychology. 1991; 7:131–149.

Wilson AE, Smith MD, Ross HD. The nature and effects of young children's lies. Social Development. 2003; 12:21–45.

Wimmer H, Perner J. Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. Cognition. 1983; 13:103–128. [PubMed: 6681741]

Wright, JC. KRISP (Kansas Reflection-Impulsivity Scale for Preschoolers). University of Kansas: Lawrence; 1971. Unpublished manuscript

Zelazo PD. Implications of 3-year-olds' successful performance on a no conflict version of the dimensional change card sort. Psychological Reports. 2006; 98:858–860. [PubMed: 16933685]

Zelazo PD, Carter A, Reznick JS, Frye D. Early development of executive function: A problem-solving framework. Review of General Psychology. 1997; 1:198–226.

Zelazo PD, Muller U. The balance beam in the balance: Reflections on rules, relational complexity and developmental processes. Journal of Experimental Child Psychology. 2002; 81:458–465. [PubMed: 11890731]

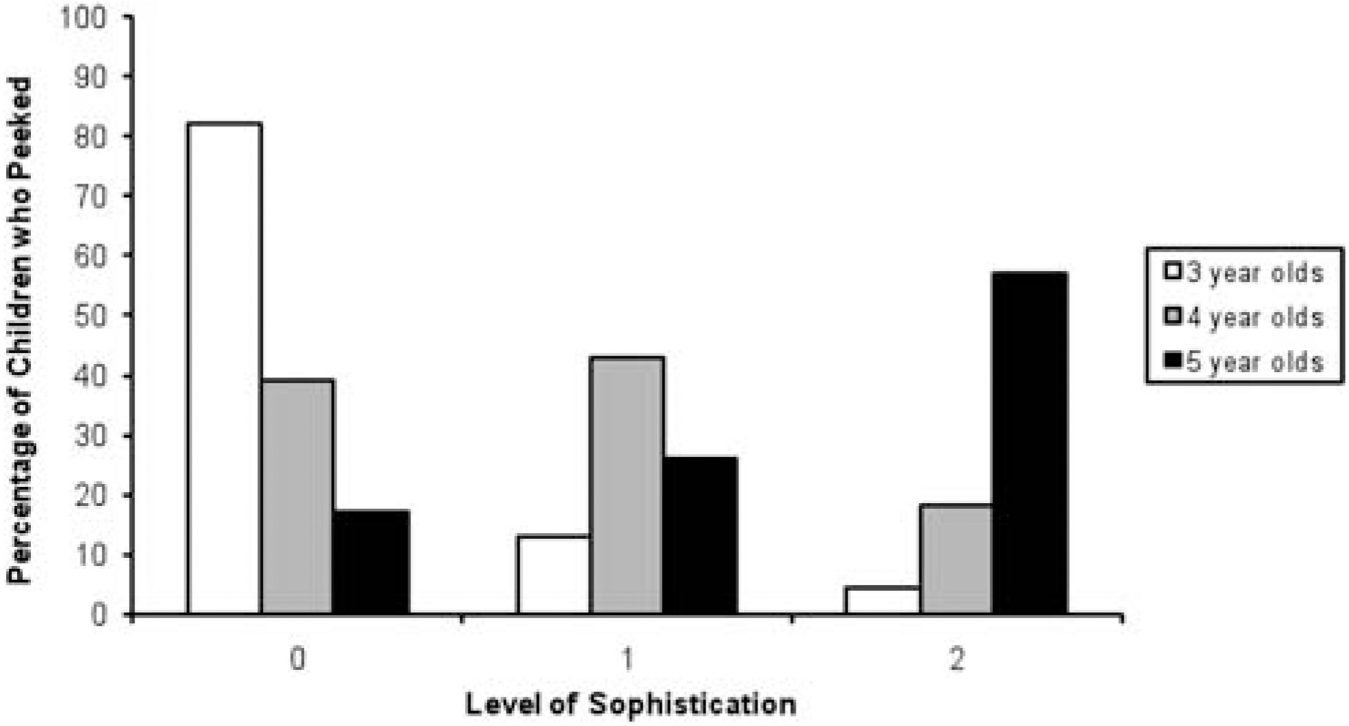

Figure 1.
Percentage of children of each sophistication level in strategic lying by age in Experiment 1.

Table 1

The Number of Children (in Percentages) Who Peeked and Lied by Age in Experiments 1 and 2

Age	Peeking	Lied
Experiment 1		
3-year-olds (*n* = 83)	41 (49.4%)	23 (56.1%)
4-year-olds (*n* = 78)	41 (52.6%)	31 (75.6%)
5-year-olds (*n* = 86)	60 (69.8%)	52 (86.7%)
Total (*N* = 247)	142 (57.8%)	106 (74.6%)
Experiment 2		
4-year-olds (*N* = 245)	144 (58.8%)	100 (69.4%)

Table 2

Mean Age (and Standard Deviation), Verbal Ability, Executive Functioning Tasks, and Theory-of-Mind Understanding by Children Who Removed Evidence of Their Transgression and All Other Children

Measure	All other children (N = 238)	Children who removed evidence (n = 7)
Age in months	54.00 (3.41)	54.43 (1.81)
Verbal ability	14.83 (5.72)	16.86 (5.76)
Day/Night	0.86 (0.22)	0.75 (0.34)
Bear/Dragon	14.44 (2.53)	15.00 (0.00)
DCCS	2.47 (1.02)	2.43 (1.13)
Tower	41.39 (15.22)	45.50 (12.00)
KRISP	8.76 (0.84)	8.38 (0.36)
Gift Delay	42.34 (20.55)	31.29 (21.99)
Motor Sequence	4.67 (1.12)	4.43 (1.13)
Theory-of-mind	5.44 (1.35)	5.29 (1.89)

Note. DCCS = Dimensional-Change Card Sort; KRISP = Kansas Reflection-Impulsivity Scale for Preschoolers.

Table 3

Correlations Between Age in Months, Verbal Ability (WPPSI), Theory-of-Mind Scores, and Executive Functioning Scores

Variable	1	2	3	4	5	6	7	8	9	10
1. Age	—									
2. WPPSI	.20*	—								
3. ToM	.15*	.29**	—							
4. Day/Night	.08	.16*	.14*	—						
5. KRISP	.22*	.35*	.23*	.14*	—					
6. Panda-lion	−.02	.12	.17*	.04	.15*	—				
7. DCCS	.14*	.23*	.43*	.17*	.30*	.22*	—			
8. Tower-Building	−.02	.02	.09	−.02	.05	−.10	.02	—		
9. Motor Sequence	.23*	.31*	.15*	.08	.21*	.22*	.22*	.04	—	
10. Gift Delay	.01	.08	.08	−.04	.09	−.02	−.01	.02	.05	—

Note. WPPSI = Wechsler Preschool and Primary Scale of Intelligence; ToM = theory-of-mind; KRISP = Kansas Reflection-Impulsivity Scale for Preschoolers; DCCS = Dimensional-Change Card Sort.

* $p < .05$.

Table 4

Correlations Between Theory-of-Mind Scores and Each of the Executive Functioning Tasks After Partialling Out the Effects of Age, Gender, and Verbal Ability

Variable	1	2	3	4	5	6	7	8
1. ToM	—							
2. Day/Nght	.09	—						
3. KRISP	.12	.07	—					
4. Panda-lion	.14*	.03	.13*	—				
5. DCCS	.38*	.13*	.22*	.21*	—			
6. Tower-Building	.08	−.03	.03	−.11	.02	—		
7. Motor Sequence	.05	.03	.08*	.21*	.14*	.04	—	
Gift Delay	.05	−.07	.04	−.04	−.05	−.01	.022	—

Note. ToM = theory-of-mind; KRISP = Kansas Reflection-Impulsivity Scale for Preschoolers; DCCS = Dimensional-Change Card Sort.

* $p < .05$.

Table 5

Summary of Tasks Used in Experiment 2

Session 1	Session 2	Session 3
Verbal ability	Day/Night Stroop	Location false belief
	Card Sort	Contents false belief
	KRISP	Location false belief (explicit)
	Panda/Lion	
	Tower-Building	
	Motor Sequence	Temptation resistance paradigm
	Gift Delay	

Note. KRISP = Kansas Reflection-Impulsivity Scale for Preschoolers.