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Elementary school children's cheating behavior and its cognitive correlates

Xiao Pan Ding [a], Danielle S. Omrin [b], Angela D. Evans [c], Genyue Fu [a,*], Guopeng Chen [d], Kang Lee [a,b,*]

[a] *Hangzhou College of Preschool Education, Zhejiang Normal University, Hangzhou, Zhejiang 310012, China*
[b] *Dr. Eric Jackman Institute of Child Study, University of Toronto, Toronto, Ontario M5R 2X2, Canada*
[c] *Department of Psychology, Brock University, St. Catharines, Ontario L2S 3A1, Canada*
[d] *School of Psychology and Cognitive Science, East China Normal University, Shanghai 200062, China*

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Elementary school children's cheating behavior and its cognitive correlates were investigated using a guessing game. Children ($n = 95$) between 8 and 12 years of age were asked to guess which side of the screen a coin would appear on and received rewards based on their self-reported accuracy. Children's cheating behavior was measured by examining whether children failed to adhere to the game rules by falsely reporting their accuracy. Children's theory-of-mind understanding and executive functioning skills were also assessed. The majority of children cheated during the guessing game, and cheating behavior decreased with age. Children with better working memory and inhibitory control were less likely to cheat. However, among the cheaters, those with greater cognitive flexibility use more tactics while cheating. Results revealed the unique role that executive functioning plays in children's cheating behavior: Like a double-edged sword, executive functioning can inhibit children's cheating behavior, on the one hand, while it can promote the sophistication of children's cheating tactics, on the other.

* Corresponding authors. Address: Zhejiang Normal University, 125 Wener Road, Hangzhou, 310012, China (K. Lee).
E-mail addresses: fugy@zjnu.cn (G. Fu), kang.lee@utoronto.ca (K. Lee).

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Introduction

Cheating is a common practice in our society (Bushway & Nash, 1977; Leming, 1978) that we often read and talk about, observe others doing, and even engage in ourselves in a variety of contexts—sports, academics, politics, finances, and relationships. Cheating is a covert and deliberate way to break a rule in order to gain an advantage (Green, 2004). Cheating not only is common during adulthood but also frequently occurs during childhood. Children's cheating behavior was one of the earliest topics to be studied in developmental psychology because the ability to follow rules while unmonitored is a major milestone in children's social and moral development (Hoffman, 1994; Kochanska, Murray, & Coy, 1997; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). Hartshorne and May (1928) conducted the first systematic investigation of children's cheating behavior through a series of studies in which participants were given the opportunity to cheat in a variety of naturalistic test-taking situations. For example, in the circle task, children were required to write specific numbers within small circles on a page with their eyes closed while alone in a room. Children were told that they would receive a prize if they succeeded on the task, thereby providing them with the motivation to cheat. Subsequently, the majority of 8- to 16-year-olds cheated on the circle task.

Extensive research on cheating has ensued for nearly a century (Evans, Xu, & Lee, 2011; Lewis, Stanger, & Sullivan, 1989; Talwar, Gordon, & Lee, 2007; Talwar & Lee, 2002, 2008). According to the existing literature, cheating behavior begins during the preschool years (Lewis et al., 1989; Talwar & Lee, 2002), with evidence that even 3-year-old children are capable of engaging in a variety of cheating practices. For example, Talwar and Lee (2002) asked children not to peek at a toy while they were left alone in a room with the toy placed behind them. The majority of 3-year-olds peeked at the toy, and all peekers returned to their original posture either as soon as they finished peeking or when they heard the experimenter opening the door. Furthermore, children's cheating behavior has been found to develop with age (Callender, Olson, Kerr, & Sameroff, 2010; Evans et al., 2011). Evans and colleagues (2011) found that when 3- to 5-year-olds were left alone in a room and asked not to lift a cup to peek at its contents, 5-year-olds tended to peek more than 3- and 4-year-olds.

However, when children enter into late childhood, a developmental decrease in cheating behavior has been identified. Talwar and colleagues (2007) used a modified temptation resistance paradigm to examine 6- to 11-year-olds' cheating behaviors by asking the children not to peek at the answer to a test question and found a developmental decrease in cheating behavior. This trend in cheating behavior has also been confirmed by Kanfer and Duerfeldt (1968), who found that as age increased among 8- to 11-year-olds, children were less likely to cheat on a number guessing game. Correspondingly, Evans and Lee (2011) used a similar temptation resistance paradigm as Talwar and colleagues (2007) and found that children's cheating behavior decreased between 8 and 16 years of age. Taken together, these studies suggest a developmental trend of cheating behaviors from late childhood into early adolescence, specifically a noticeable decrease.

The reasons why children exhibit a decrease in the decision to cheat during their late childhood and early adolescent years remains unknown. However, several individual differences and environmental factors that affect children's cheating behaviors have been examined (e.g., gender, sociometric status, children's beliefs, morality) (Asendorpf & Nunner-Winkler, 1992; Guttmann, 1984; Jensen-Campbell & Graziano, 2005; Piazza, Bering, & Ingram, 2011; Rubin & Hubbard, 2003; Silverman, 2003).

In terms of cognitive factors, limited existing research appears to suggest that skills such as children's executive functioning (EF) and theory-of-mind (ToM) understanding may be related to their decision to cheat (Kochanska et al., 1996, 1997; Talwar et al., 2007). EF refers to a set of higher order psychological processes that are involved in goal-oriented behavior (Zelazo & Müller, 2002), including cognitive skills such as inhibitory control, planning, cognitive flexibility, and working memory (Diamond, 2006; Testa, Bennett, & Ponsford, 2012). Previous studies that examined the relationship between the internalization of rules and EF found that preschool children with higher inhibitory control were better at internalizing their caregivers' rules because it is believed that inhibitory control contributes to conscience development (Kochanska et al., 1996, 1997). Furthermore, although preschool children are likely to be aware of moral rules about cheating, they may have difficulty in holding them in mind when faced with a salient temptation to cheat. For older children, it may be that having better working memory allows them to simultaneously represent both types of information in mind to resist cheating successfully. Thus, one's ability to resist cheating depends on both inhibitory control and working memory.

ToM may also play an important role with regard to the decision to cheat. Children must have the understanding that another person's belief may deviate from reality and that his or her covert actions might not be known to others (first-order false belief understanding), especially if the person's actions were never witnessed. Extensive evidence indicates that there is a dramatic shift in children's first-order false belief understanding between 3 and 6 years of age (Liu, Wellman, Tardif, & Sabbagh, 2008; Wellman, Cross, & Watson, 2001) such that it increases with age. This trend parallels the development of younger children's cheating behavior (Talwar & Lee, 2002). Research has found that at around 6 years of age, the ability to understand one person's false belief about another person's belief (second-order false belief understanding) begins to emerge and undergoes steady development well into adolescence (Sullivan, Zaitchik, & Tager-Flusberg, 1994). Second-order false belief understanding may affect older children's cheating behavior as well because to cheat successfully older children must consider not only whether another individual has a false belief about his or her covert action but also what subsequent beliefs the person ought to have given the initial false belief. Previous studies all have failed to find any significant relationships between false belief understanding or EF and peeking behaviors in 3- to 11-year-old children (Evans et al., 2011; Talwar & Lee, 2008; Talwar et al., 2007). However, this is likely due to the fact that these studies were designed to examine children's lie-telling behaviors, rather than cheating, and used paradigms that elicited cheating in the majority of children. Consequently, in these paradigms either cheating was not specifically explored, only a single trial of cheating was observed, or there was insufficient variability to examine the cognitive correlates.

Although studies have neglected to find a relation between children's cheating behavior and sociocognitive factors, evidence has been found to support the relation between another dishonest behavior and children's EF skills and ToM understanding, specifically children's lie telling. Lying refers to intentionally instilling a false belief in another person (Barnes, 1994; Bok, 1989; Sweetser, 1987). In contrast to cheating, the goal of lying is to manipulate another person's belief, whereas the goal of cheating is to deliberately break a rule to gain an advantage. Although the core motivation for each of these acts differs, they both often require a deceptive act. Thus, the literature on children's lie-telling and sociocognitive skills may shed light on possible relations between cheating and sociocognitive skills. In particular, children's working memory and inhibitory control skills have been found to assist in their lie-telling ability (e.g., Evans & Lee, 2011, 2013; Evans et al., 2011; Talwar & Lee, 2008; Talwar et al., 2007). Children with better working memory were significantly better at concealing their lie during follow-up questioning because children must keep in mind what rule they have transgressed while producing an alternative statement. In terms of inhibitory control skills, children with better inhibitory control skills were significantly better able to conceal their transgression and previous lies. It is suggested that inhibitory control skills allow children to inhibit the truth, allowing them to in turn produce a lie (e.g., Talwar & Lee, 2008). Finally, second-order ToM understanding has also been linked to children's lie-telling abilities such that those children with better second-order ToM are significantly better at concealing their lies (Talwar et al., 2007).

Although connections have been made between children's lie-telling behaviors and sociocognitive skills, many questions have been left unexplored regarding children's cheating behaviors such as their decision to cheat or not, the frequency of cheating once they have decided to cheat, and the cheating tactics used. In fact, a "good cheater" is not one who cheats excessively but rather one who cheats moderately to avoid detection. It is possible that children's working memory may be negatively related to the frequency of cheating. Working memory may help children to monitor their recent actions in their short-term memory. Thus, children with good working memory may be more adept at keeping track of how many times they have cheated and may adjust the frequency of their cheating to avoid being caught too often.

Furthermore, to make one's cheating behavior less susceptible to detection, a good cheater may use multiple cheating tactics. Although there are no studies that have specifically examined children's cheating tactics and whether or not they are related to ToM and EF (e.g., working memory, inhibitory control, cognitive flexibility), it is possible that children's ToM and EF may be positively related to their ability to recruit a variety of tactics. Second-order false belief understanding can help children to infer that the target may have suspicions that their own statement may be false and not accurately reflecting the true state of affairs. As a result, it becomes important to adopt various tactics to avoid being caught as a cheater. Other supporting evidence is that cognitive flexibility, a component of EF, can help an individual to switch between multiple demanding tasks such as switching between truthful and deceptive responses (Christ, Van Essen, Watson, Brubaker, & McDermott, 2009).

The goal of the current study was to investigate children's cheating behavior and its related cognitive factors, including EF and ToM. In this study, elementary school children's cheating behaviors were examined using a guessing game modeled after Greene and Paxton (2009). The guessing game was designed to be sufficiently motivating so that some, but not all, children would cheat, thereby creating adequate variability in cheating behavior for investigating the cognitive correlates. Furthermore, this game also allowed for children to use different tactics to avoid being caught as cheaters. During the game, children were instructed to guess which side of the screen a coin would appear on and to make their prediction by moving their corresponding hand under a desk so that the experimenter would not be aware of their prediction. Following their prediction, children were required to state whether they guessed correctly. Children were told that they would receive points for guessing correctly and lose points for guessing incorrectly. Because children knew that the experimenter could not see their hand movements under the desk, it created an opportunity for them to cheat by telling the experimenter that they were correct when they predicted incorrectly. However, unbeknownst to the children, a video camera was hidden under the table to capture their hand movements. Three dependent variables were used to measure children's cheating behavior: (a) whether they decided to cheat or not (decision to cheat), (b) the frequency of cheating (the total number of trials where cheaters cheated divided by the total number of trials where they did not guess correctly), and (c) the number of tactics used to cheat.

After the guessing game, children performed one task that assessed their ToM understanding. Given that elementary school children are at ceiling for first-order false belief tasks, we used only second-order false belief tasks to examine their ToM understanding. Children also performed three tasks that assessed their executive function ability; Digit Span Backward was used as a working memory measure, and the Word–Color Stroop task and Flanker Fish task (Mixed Fish task) were used as inhibitory control and cognitive flexibility measures respectively (Astington, Pelletier, & Homer, 2002; Diamond, 2006; Diamond, Barnett, Thomas, & Munro, 2007; Sullivan et al., 1994).

Based on existing studies, we expected that elementary school students would be less inclined to cheat with increased age (Evans & Lee, 2011; Kanfer & Duerfeldt, 1968; Talwar et al., 2007). It was also expected that children with stronger working memory and inhibitory control would be less likely to cheat, or would cheat less often, compared with children with weaker working memory and inhibitory control (Evans et al., 2011; Kochanska et al., 1996, 1997). However, better cognitive flexibility was expected to be positively associated with children's cheating tactics (Christ et al., 2009). Furthermore, it was hypothesized that children's second-order false belief understanding would predict the sophistication (number) of cheating tactics used (Talwar & Lee, 2008; Talwar et al., 2007).

Method

Participants

A sample of 98 children between 8 and 12 years of age participated in the study (M_{age} = 9.71 years, *SD* = 1.75, 54 boys and 44 girls). All children were Han Chinese and were native speakers of Mandarin. Children were from three different classes at an elementary school located in an eastern city of Mainland China. Furthermore, each age group of children was from the same class. Among the sample, 33 children were from multiple-child families and 65 children were from single-child families. Children came from families with varying socioeconomic backgrounds. In terms of parental education attainment, 15% were at the elementary school level, 52% at the middle school level, 22% at the high school level, and 11% at the college level. Informed consent was obtained from all parents prior to beginning the study, and oral assent was obtained from all child participants.

Measures and procedure

Participants were individually tested in a quiet room. Children first completed the guessing game as a measure of their cheating behavior. Next, children completed two sets of cognitive tasks: second-order false belief tasks and EF tasks. The guessing game was always completed first, followed by the cognitive measures. The order of the cognitive tasks was counterbalanced between participants. The duration of the entire session was approximately 45 min.

The guessing game

During the game, children were seated in front of a computer screen and asked to keep their hands in their laps. Before the game, children were told that a coin would appear on either the left or right side of the screen. They were instructed to guess which side of the screen the coin would appear on by slightly moving their corresponding hand under the table so that their decision (i.e., hand movement) would not be apparent to the researcher sitting beside them. Children were then told that following each coin appearance, a message would come up on the screen asking them whether their guess was the same as the outcome of the coin placement ("The same or not?"), and their job was to provide a verbal response ("the same" or "not the same") to the question. The researcher recorded each child's response and was blind to whether the child cheated or not because the researcher could not see the child's hand movements under the table. To check whether children cheated or not for each trial, two hidden cameras were strategically hidden inside computer speakers that were placed beside children's hands to capture their movements. Before the game started, children were given approximately 8 practice trials where the experimenter instructed children to make a guess and move their hands before the coin appeared. These practice trials were to ensure that children understood the rules and could move their hands correctly in accordance with their guesses. All children successfully followed the instructions during these practice trials. During the test trials, children received 10 points if they correctly guessed the location of the coin and lost 10 points if they incorrectly guessed the location of the coin. Children were encouraged to try their best to obtain the highest score possible so that they could compare their scores with those of their classmates (there was no mention of monetary awards). After children completed 20 trials, the computer program paused and the experimenter told children that they did not perform very well in an attempt to increase their motivation to cheat. Thereafter, children completed another 20 trials. On completion, children were told that they did very well during the last 20 trials and were asked not to discuss their scores immediately with their classmates until they were formally debriefed and the entire experiment was finished.

The software package E-Prime 1.2 was used to randomize the presentation of the stimuli. Each trial began with the presentation of a fixation cross (2–3 s), followed by the instruction "please guess" (2 s), and subsequently a coin would appear on either the right or left side of the screen. After the coin disappeared and the participant made a verbal response as to whether he or she guessed correctly or incorrectly, the participant's updated score was displayed on the screen.

After the experiment, the research assistant checked the videos of children's hand movements (which were synchronized with video footage of the computer screen) and recorded whether or not children cheated by comparing their hand movements with their verbal responses that were entered into the computer during the testing session. Children's responses were coded into one of the following categories: correct–non-cheating (answered "the same" when they guessed correctly), incorrect–non-cheating (answered "not the same" when they guessed incorrectly), and cheating (answered "the same" when they guessed incorrectly). None of the children cheated by stating "not the same" when they correctly guessed the location of the coin. Children who did not cheat during the entire testing session were classified as *non-cheaters*, and children who cheated at least once during the session were classified as *cheaters*. Thus, the decision-to-cheat scores ranged from 1 (*cheated at least once*) to 0 (*did not cheat at all*). Among the cheaters, we further obtained a measure of the frequency of cheating. This measure was obtained using the total number of trials in which participants cheated divided by the total number of trials in which they did not guess correctly. We also obtained a measure of the number of tactics used in the process of cheating. Children who cheated used a variety of tactics during the course of the game, including (a) keeping both hands still while guessing, (b) moving both hands while guessing, and (c) moving their hands after the coin appeared on the screen. After watching the hidden camera footage, the number of tactics were recorded on a scale of 0 to 3, with 0 representing *no tactics cheaters* (e.g., moved one hand that incorrectly corresponded to the location of the coin), 1 representing *one type of tactic used*, and 3 representing *all three types of tactics used*, as described above.

Theory-of-mind understanding

Two second-order false belief stories were administered. The order of the stories was counterbalanced between participants. Both second-order belief stories were adapted from Astington and colleagues (2002) and Sullivan and colleagues (1994). One story involved a girl named Huahua and her mom. In this story, the mom wants to surprise Huahua with a puppy for her birthday, so she hides the puppy in the basement and tells Huahua that she got her a really great toy instead of a puppy for a gift. When Huahua goes down to the basement to get her rollerblades, she finds the birthday puppy! After the picture display, children were asked three control questions regarding the character's actions: "Does Huahua see the puppy?", "What does Huahua think she will get for her birthday gift?", and "Does the mom know that Huahua saw the puppy in the basement?" Only if children answered the control questions correctly would the experimenter move on to the last question. The final question was the target question: "What does the mom think Huahua will tell her friends she got for her birthday gift?" For each correct response, a score of 1 was given to each child.

The second story involved two children: Zhuangzhuang and Meimei. In this story, Zhuangzhuang puts his crayon into the desk and then leaves the room. Meimei wants to play a trick on him, so she takes the crayon from the desk and puts it into the basket. While Meimei is busy hiding the crayon, Zhuangzhuang is watching her through the door. After the picture display, children were asked three control questions: "Can Zhuangzhuang see Meimei?", "Where does Zhuangzhuang think the crayon is?", and "Does Meimei think that Zhuangzhuang can see her?" Only if children answered the control questions correctly would the experimenter move on to the final target question: "Where does Meimei think Zhuangzhuang will look for the crayon when he comes back into the room?" Each child received a score of 1 for correctly answering each question. The total score for the two second-order false belief stories was out of 2, which henceforth is referred to as the "second-order false belief score."

Executive function

To test children's executive function, three tasks were used: Digit Span, Word–Color Stroop, and Flanker Fish. The Digit Span Backward task was taken from the Wechsler Intelligence Scale for Children–Fourth Edition. Children were given strings of numbers and were asked to repeat the numbers back to the experimenter in the reverse order. Participants' scores for the total number of strings correct (ranging from 0 to 16) were recorded as Digits Backward working memory score (Baddeley, 1986).

To evaluate children's inhibitory control skills, the Word–Color Stroop task was administered (Cohen, Dunbar, & McClelland, 1990). First, participants were presented with a page of words, including RED (in Chinese), BLUE (in Chinese), and YELLOW (in Chinese) printed in black ink repeatedly in random order. Participants were asked to read as many words as possible within 45 s (Word trial). Then, children were presented with "XXXX" printed in blue, red, or yellow ink repeatedly in random order and were asked to name the colors of the ink as fast as possible within 45 s (Color trial). Finally, participants were presented with color words printed in a contrasting color and were asked to name the color of the ink regardless of the word that was printed (Word–Color trial), again within 45 s. An interference score was calculated by subtracting the total number of words read on the Color trial from the total number of items read on the Word–Color trial. The interference score was used as a measure of children's inhibitory control skills.

To further assess children's cognitive flexibility, the Mixed Fish task in the Flanker Fish task was administered (Diamond et al., 2007; Röthlisberger & Neuenschwander, 2012). The Mixed Fish task involved both blue fish and pink fish subtasks. The Blue Fish subtask required children to make a response based on the orientation of a central target stimulus, a blue fish, by pressing the corresponding key to indicate whether the fish was facing right or left. The Pink Fish subtask required children to make a response based on the orientation of the outside fish. There are two conditions in the task; one is the congruent condition, where the flanker fish are facing the same direction as the central target fish, and the other is the incongruent condition, where the flanker fish are facing in the opposite direction. After a practice session with 4 trials, each child completed 17 test trials for both the blue fish and pink fish subtasks. Finally, the Mixed Fish task involved both blue and pink fish, so children were required to remember the different rules according to the different fish colors and press the appropriate keys. All trials were presented in random order, where each stimulus was displayed for 1500 ms, for a total of 45 Mixed Fish trials. In this task, a practice session did not precede the test trials. The dependent variable was the inverse efficiency score of the Mixed Fish task. The inverse efficiency scores expressed in milliseconds were computed to account for the speed–accuracy trade-offs; that is, reaction latencies for the task were divided by their corresponding accuracy so that differences in reaction time performance would decrease if differences in accuracy are large but would remain the same if accuracy is identical. These inverse efficiency scores were then used in the subsequent analyses as a measure of cognitive flexibility (Röthlisberger & Neuenschwander, 2012).

Results

To examine children's cheating behavior in relation to different cognitive measures, a series of analyses was conducted. First, descriptive statistical results regarding children's cheating behavior were obtained. Second, to examine which cognitive factors predicted children's cheating behavior, three regression analyses were performed.

Data from 95 children were included in the final analyses. Three participants' data were missing, either because the children were unable to complete the whole session or due to procedural errors. Preliminary results revealed no significant effect for gender or family socioeconomic status (SES, as measured by parental education levels). Thus, the results for these factors were collapsed for all subsequent analyses. The descriptive results of age, ToM, and EF tasks by children who were non-cheaters and cheaters can be found in Table 1.

Descriptive analysis of cheating behavior

Approximately 58% of participants (55 of 95) cheated at least once during the guessing game, demonstrating that the guessing game did indeed elicit cheating behaviors that could be examined. Among the participants who cheated ($n = 55$), the mean frequency of cheating (the total number of trials where cheaters cheated divided by the total number of trials where they did not guess correctly) was 37%.

For those children who cheated, some children did not employ any tactics, whereas other children used several tactics during the course of the game, including (a) keeping both hands still while guessing, (b) moving both hands while guessing, and (c) moving their hands after the coin appeared on the screen. After watching the hidden camera footage, the number of tactics were recorded on a scale of 0 to 3, with 0 representing *no tactics cheaters* (e.g., simply moved one hand that incorrectly corresponded to the location of the coin such that they were cheating but not attempting to employ a strategic tactic), 1 representing *one type of tactic used*, 2 representing *two types of tactics used*, and 3 representing *all three types of tactics used*. The mean number of tactic types used to cheat was 0.72 ($SD = 0.68$). We separated participants who cheated into three groups based on the number of tactics

Table 1
Mean age, theory-of-mind understanding, and executive functioning task performance by cheating behavior and grade.

Measurement	Non-cheater ($n = 40$)	Cheater ($n = 55$)	Grade 2 ($n = 33$)	Grade 4 ($n = 31$)	Grade 6 ($n = 31$)
Age (years)	10.59 (1.58)	9.07 (1.58)	7.67 (0.36)	9.81 (0.38)	11.79 (0.37)
Second-order false belief task	1.35 (0.70)	1.13 (0.72)	1.09 (0.77)	1.16 (0.69)	1.42 (0.67)
Digit span backward	5.18 (1.77)	3.96 (1.40)	3.85 (1.54)	4.39 (1.45)	5.23 (1.75)
Color–word interference score	−26.50 (8.63)	−28.38 (8.78)	−24.42 (6.94)	−28.74 (8.62)	−29.81 (9.75)
Inverse efficiency score of mixed fish task (ms)	1143 (227)	1356 (524)	1576 (592)	1155 (164)	1048 (172)

Note. Standard deviations are in parentheses.

they used: (a) the no tactics group ($n = 21$), (b) the one tactic group ($n = 29$), and (c) the two or more tactics group ($n = 5$).

Relations of cognitive measures to children's cheating behavior

Decision to cheat

To examine the relationship between the decision to cheat and its cognitive correlates, a hierarchical logistic regression was conducted with children's cheating or lack thereof as the predicted variable (where 0 = *non-cheater* and 1 = *cheater*) and age in years as a continuous predictor variable. Age was entered into the model on the first step, followed by ToM on the second step and three EF factors (Digit Span Backward score, Color–Word interference score, and the inverse efficiency score of the Mixed Fish task) on the third step. The first model was significant, $\chi^2(1, 95) = 18.97$, Nagelkerke $R^2 = .24$, $p < .01$, indicating that as age increased, participants were significantly more likely to tell the truth than to cheat. Specifically, the odds ratio (*OR*) indicates that for each year increase in age, participants were 1.77 times less likely to cheat.

After partialling out the effect of age, the second step was not significant, suggesting that the decision to cheat was unrelated to ToM. Finally, after partialling out the effects of age and ToM, the third step was significant, $\chi^2(3, 95) = 13.71$, Nagelkerke $R^2 = .40$, $p < .01$, suggesting that executive function measures were significantly related to children's decision to cheat. When examining which specific scores significantly contributed above and beyond all other common contributions in the model, only the Digit Span Backward score and the Color–Word interference score were significant ($\beta = -.45$, Wald = 7.00, $p < .01$, $OR = 1.56$, and $\beta = -.08$, Wald = 6.38, $p < .05$, $OR = 1.10$, respectively). The results indicate that with better working memory ability and increased inhibitory control ability, children were significantly less likely to cheat. The odds ratio suggests that with each 1-point increase in Digit Span backward score, children were 1.56 times less likely to cheat. Furthermore, with each 1-point increase in Color–Word interference score, children were 1.10 times less likely to cheat.

Frequency of cheating

To examine the relationship between the frequency of cheating in cheaters and its cognitive correlates, a linear regression was performed with the frequency of cheating as the predicted variable. Age in years (continuous variable) was entered on the first step, followed by ToM on the second step and the three EF factors on the final step.

The first model with age in years was not significant, indicating that once children decided to cheat, their frequency of cheating was unrelated to their age. The second and third models were also not significant, indicating that once children decided to cheat, their frequency of cheating was unrelated to their ToM and EF scores.

Number of tactics used to cheat

To explore whether EF and ToM are related to the sophistication of cheating tactics, a linear regression was performed with number of tactics used in the guessing game as the predicted variable. Age in years (continuous variable) was entered on the first step, followed by ToM on the second step and the three EF factors on the final step.

The first and second models with age and ToM were not significant. However, the third model was significant, $\Delta F(3, 49) = 3.83$, $p < .05$, $\Delta R^2 = .19$, suggesting that ToM and EF measures were significantly related to participants' ability to use a variety of cheating tactics. When examining which specific scores significantly contributed above and beyond all other common contributions in the model, only the inverse efficiency score of the Mixed Fish task was found to be significant ($\beta = -.49$, $t = -3.29$, $p < .01$, part correlation = $-.42$). Specifically, for those participants who cheated, a higher ability in cognitive flexibility was related to using more sophisticated tactics in cheating. These results indicate that participants with better cognitive flexibility were more adept at cheating and adopting different tactics.

Discussion

The current study examined the development of cheating behavior in elementary school children and its cognitive correlates. With regard to children's decision to cheat, we found that the majority of children cheated during the guessing game, which is consistent with previous findings on cheating behaviors among elementary school students (Callender et al., 2010; Evans & Lee, 2011; Guttmann, 1984; Kanfer & Duerfeldt, 1968; Piazza et al., 2011; Rubin & Hubbard, 2003). The current study also revealed that there is a developmental decrease in cheating behavior as children increase in age from late childhood into early adolescence, which again is consistent with previous findings (Evans & Lee, 2011; Kanfer & Duerfeldt, 1968; Talwar et al., 2007).

To understand why cheating behavior decreases across these age groups, children's cognitive abilities were also examined in relation to their cheating behaviors. The results revealed that children's EF abilities mutually affected their decision to cheat; the greater children's EF abilities, the less likely they were to cheat. In addition, above and beyond the common contributions of all the sociocognitive factors, children's inhibitory control and working memory scores uniquely contributed to their decision to cheat. One possible explanation for these results may be that inhibitory control plays an important role in the internalization of rules because in order to follow a rule children must actively inhibit their impulses and comply with their caregivers' standards of conduct (Kochanska & Aksan, 2006; Kochanska et al., 1996, 1997). However, in cheating children must break rules to gain an advantage, and this usually occurs because they have difficulty in internalizing the rules and resisting temptation. Thus, in the current study, children with low inhibitory control could not resist gaining a higher score and consequently broke the rules they were given, which resulted in cheating. Working memory has been found to be directly related to children's lie telling about their own transgressions (Evans & Lee, 2011) because such deception requires children to keep in mind what rules they have transgressed. In the current study, to resist the temptation of cheating when faced with the motivation to do so, children needed to hold in mind the rules of the game. Thus, consistent with our hypothesis, we found that the ability to resist cheating was related to children's inhibitory control and working memory.

In addition to the decision to cheat, we further focused on children who cheated. Inconsistent with our hypothesis, we found that ToM, EF, and age were not significantly related to how frequently the cheaters cheated. One possible reason for these findings is that, compared with the decision to cheat, the frequency of cheating may have been affected more by situational factors such as the number of points that children already gained, the intensity of temptation, and the intensity of guilt that children were feeling. Another possible explanation is that children may have used the strategy of discretion; they cheated less often to make their cheating behavior less obvious. Thus, it might be the case that the frequency of cheating does not follow a monotonic function. The frequency of cheating might be an even more difficult variable to examine because it is a measure that combines potentially opposing processes—an age-related decrease in motivation for cheating and an age-related increase in recognizing the optimal number of times one should cheat. Thus, future studies should ascertain additional factors, such as children's personality and motivation toward rewards, which may affect children's frequency of cheating in more detail.

Nevertheless, we found that the cheaters' EF abilities were significantly related to the number of tactics they used. Furthermore, children's cognitive flexibility uniquely accounted for their use of tactics. Cognitive flexibility was positively associated with children's use of cheating tactics, which was consistent with our hypothesis. It appears that in the process of cheating, children were required to flexibly update and switch their cheating tactics to avoid being caught as cheaters. In the current guessing game, children could choose to cheat and do so successfully in various ways. It is possible that the use of different strategies requires deployment of cognitive flexibility, which is likely not specifically related to cheating tactics but rather generally related to using a variety of tactics in any context. Thus, future studies may want to further explore the role of cognitive flexibility.

One surprising finding was that ToM was unrelated to children's cheating behavior in both the decision to cheat and the number of tactics used to cheat. This may be attributed to the fact that ToM is more strongly related to children's verbal ability (Talwar et al., 2007), but not to the nonverbal ability of making the decision to cheat or using various tactics to cheat. This finding was consistent with the results found by Talwar and colleagues (2007), who also found that although children's ToM was related to their ability to verbally conceal their lies, it was unrelated to their nonverbal expressive behaviors.

Examining the relation between EF and deceptive behaviors in general, we note that a slightly different pattern of results emerges for cheating and lie-telling behaviors. In particular, previous studies found that EF is positively correlated with children's lying behavior, whereas the current study demonstrated a negative relation between EF and children's decision to cheat while positively related to the sophistication of cheating (i.e., the number of tactics used). However, the differing directional relations with EF support the idea that although EF is required to resist transgressing, once a decision to transgression has occurred EF is required to successfully conceal that transgression either through lying or by strategically using multiple tactics of cheating to avoid detection.

Furthermore, future studies are needed to explore whether an increased understanding of probability contributes to decreases in cheating behavior. It is possible that as children grow older, their cheating behavior decreases because they acquire a better understanding of the role of probability in a chance game like the one used in the current study. As children gain a better understanding that their chances of guessing correctly is random and unrelated to their ability, they may be less motivated to cheat. It may be beneficial for future studies to explore the relationship between cheating behavior during childhood and other behavioral problems or criminal problems during adolescence or adulthood. Previous studies that have looked at cheating as a behavioral problem have considered it to be a strong predictor of both drug use during emerging adulthood (Loeber, Stouthamer-Loeber, & White, 1999; Rohrbach, Sussman, Dent, & Sun, 2005) and peer rejection during middle childhood (Pedersen, Vitaro, Barker, & Borge, 2007). Furthermore, these studies have shown that chronic cheating behavior contributes to the development of delinquent behaviors.

In summary, the current findings demonstrate that the majority of 8- to 12-year-old children will cheat and that their decision to cheat decreases with age. In addition, executive function ability plays a unique role in children's decision to cheat and whether to use any strategies such as adopting a variety of cheating tactics. Specifically, children with better inhibitory control and working memory will choose to cheat less often. However, once they decide to cheat, children with better cognitive flexibility will use a greater variety of tactics to cheat. Taken together, the current findings suggest that, just like a double-edged sword, EF can lead to the inhibition of cheating behavior, on the one hand, and the promotion of cheating tactics, on the other.

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