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Verbal Deception From Late Childhood to Middle Adolescence and Its Relation to Executive Functioning Skills

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Abstract

The present investigation examined 8- to 16-year-olds' tendency to lie, the sophistication of their lies, and related cognitive factors. Participants were left alone and asked not to look at the answers to a test, but the majority peeked. The researcher then asked a series of questions to examine whether the participants would lie about their cheating and, if they did lie, evaluate the sophistication of their lies. Additionally, participants completed measures of working memory, inhibitory control, and planning skills. Results revealed that the sophistication of 8- to 16-year-olds' lies, but not their decision to lie, was significantly related to executive functioning skills.

Keywords

executive functioning; deception; children; adolescents

Research on dishonesty in late childhood to middle adolescence began as soon as developmental psychology became a discipline of scientific research. Hartshorne and May (1928) were the first to examine dishonest behaviors in this age range through a series of studies in which participants were given the opportunity to cheat in a variety of naturalistic test-taking situations. Hartshorne and May found that, overwhelmingly, the majority of participants cheated on these tasks. However, because the participants' behavior was not followed up with further probes, it was unclear whether the participants in their studies would also compound their transgression by lying.

Knowledge about the normative development of lying behavior in late childhood into adolescence is important for a number of reasons. First, it is now well established that lying is a common and normative behavior among typically developing preschool and young elementary school children (e.g., Hala, Chandler, & Fritz, 1991; Lewis, Stanger, & Sullivan, 1989; Peskin, 1992; Polak & Harris, 1999; Talwar & Lee, 2002; for a review, see Lee & Evans, in press). However, existing, albeit limited, research suggests lying in older children and particularly adolescents to be associated with behavioral problems, conduct disorders, and delinquency (American Psychiatric Association, 2000; Gervais, Tremblay, Desmarais-Gervais, & Vitaro, 2000; Gervais, Tremblay, & Héroux, 1998; Lane, 1987; Warr, 2007). It is currently unclear whether this apparent age difference is due to the lack of normative data

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about lying in typically developing populations in late childhood and adolescence or the fact that there indeed exists a dramatic shift from a normative behavior in early and middle childhood to an abnormal behavior in late childhood into adolescence. Thus, empirical evidence about the lie-telling behaviors during late childhood into the adolescent years should address these important possibilities.

Second, existing research with younger children and adults has identified a number of social-cognitive factors that play an important role in the development of verbal deception such as theory-of-mind understanding and executive functioning skills (e.g., DePaulo et al., 2003; Gombos, 2006; Talwar, Gordon, & Lee, 2007; Talwar & Lee, 2008; Walczyk, Roper, Seemann, & Humphrey, 2003; Walczyk et al., 2005). It is crucial to understand whether these factors continue to exert their influences in adolescence, a period that is well known for major biological and social changes, to obtain a comprehensive picture of the development of lying.

Finally, although moral development research has demonstrated an increased sophistication of adolescents' understanding of lying (Lee & Ross, 1997; Perkins & Turiel, 2007), it is currently unknown how this conceptual–moral understanding transfers into action. On the one hand, on the basis of Perkin and Turiel's (2007) findings indicating that adolescents typically value honesty, it would be expected that lie telling would be less frequent in adolescents. On the other hand, when considering Lee and Ross's (1997) findings suggesting that as age increases, adolescents' conception of lying become more nuanced (e.g., intentional untruthful statements told in some situations were classified not to be lies), one would predict that adolescents would be more inclined to tell lies. However, both of these predictions are based on adolescents' conception and their moral understanding of deception. Given the general lack of relationship between moral behavior and moral understanding (Arnold, 1989; Blasi, 1980; Talwar, Lee, Bala, & Lindsay, 2002, 2004; Thoma & Rest, 1986), such studies can provide only some hint about adolescents' actual lying behavior. Currently, it is not known whether a sophisticated understanding of lies will transfer to actual behavior during late childhood and into adolescence.

There are some studies that have examined adolescents' actual lying behavior, but they have mainly relied on self-reports by adolescents themselves or teacher and parent reports (Darling, Cumsille, Caldwell, & Dowdy, 2006; DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996; Jensen, Arnett, Feldman, & Cauffman, 2004; Stouthamer-Loeber & Loeber, 1986). Self-report methods can at best provide an indirect measure of the inclination to lie for a number of reasons. For example, due to people's general negative views about deceiving others, these individuals may be underreporting their lying. On the other hand, some adults may be biased to believe that adolescents are prone to tell lies and consequently overreport their tendency of lying. Whereas most of the studies examining self and others' reports of deception have provided information on how often adolescents lie and the type of lies they tell, they have so far failed to reveal the sophistication of adolescents' ability to lie. Thus, it is important to investigate how the tendency to lie and the ability to tell a sophisticated lie develop from late childhood into adolescence and whether the development of lying in late childhood and adolescence continues to be influenced by the related social-cognitive factors.

The majority of studies using behavioral measures to assess the development of lie telling have focused on younger children and adults. Lie telling has frequently been demonstrated to begin during the preschool years (Hala, Chandler, & Fritz, 1991; Lewis, Stanger, & Sullivan, 1989; Peskin, 1992; Polak & Harris, 1999; Talwar & Lee, 2002). By 4 years of age, children demonstrate clear signs of intentions to deceive others (Polak & Harris, 1999). Not only does the frequency with which children tell lies increase with age (Gervais et al., 2000; Talwar & Lee, 2002; Wilson, Smith, & Ross, 2003), but the sophistication of such lies also increases. Although developmental self-report studies demonstrate that lie-telling rates decrease into emerging adulthood (Jensen et al., 2004), studies of adults' lie telling in everyday life suggest that lying is a common part of adults' daily communication (Camden, Motley, & Wilson, 1984; DePaulo & Kashy, 1998; DePaulo et al., 1996; Hample, 1980; Turner, Edgley, & Olmstead, 1975).

Only one research study to date has examined lie-telling behaviors from middle childhood to early adolescence. Talwar et al. (2007) used a modified temptation resistance paradigm and asked 6- to 11-year-olds not to peek at the answer to a test question while left alone in a room. Hidden cameras in the room revealed that half the children cheated and peeked at the test answer. Upon returning to the room, the researcher asked participants whether they had peeked at the answer, and almost all the participants who peeked lied and denied peeking. Two follow-up entrapment questions were asked about irrelevant details on the back of the card that participants ought not to know unless they peeked (e.g., "What color is the writing on the back of the card?") to assess their ability to maintain semantic leakage. Participants skilled in concealing their transgression should have feigned ignorance to the irrelevant details on the back of the card, because claiming to know such information would reveal the fact that they had peeked at the back of the card. Although Talwar et al. did not find a developmental difference in the rate of lie telling, it was found that as age increased, participants were significantly more likely to feign ignorance and successfully conceal their transgression.

It has been suggested that the development of executive functioning skills may be related to the tendency to lie and the sophistication of lies (Evans, Xu, & Lee, 2011; Gombos, 2006; Talwar & Lee, 2002, 2008). Executive functioning skills have been defined as higher order psychological processes involved in goal-oriented behavior under conscious control (Zelazo & Müller, 2002), including such cognitive skills as inhibitory control, planning, cognitive flexibility, and working memory (Welsh, Pennington, & Groisser, 1991; Zelazo, Carter, Reznick, & Frye, 1997). These skills are thought to play an important role in making decisions, problem solving, and other complex cognitive tasks (Baddeley, 2000).

It has specifically been suggested that inhibitory control, working memory, and planning are related to lie-telling abilities (Carlson & Moses, 2001; Carlson, Moses, & Hix, 1998; Evans et al., 2011; Gombos, 2006; Talwar & Lee, 2008; Walczyk et al., 2003, 2005). Inhibitory control, or an individual's ability to suppress a response or behavior while completing a separate goal, is believed to be required to tell a lie, as one must inhibit the truth while reporting false information. Working memory, a system for temporarily holding and processing information in the mind (Baddeley, 1986), is believed to be required to lie successfully, as one must keep separate in memory the details of the lie and the true state of affairs. Finally, it has been suggested that to successfully tell a lie, individuals must be able to create a plan of deception by organizing the statements in a consistent fashion (e.g., maintaining semantic leakage control) such that their untruthful statements can effectively conceal their transgression. A model that integrates the requirements of these cognitive skills is the activation– decision–construct model (ADCM) developed by Walczyk et al. (2003). The ADCM is a cognitive-based theory of deception that has three components. The first component is the activation of information, which requires working memory to hold the activated memories and knowledge of the truth. This is followed by the decision-making component in which the decision to tell the truth or a lie requires inhibition to suppress critical details related to the truth when a lie is made. Finally, the construction component, in which a plausible alternative to the truth is constructed, requires attention. However, when the speaker's intention is to respond honestly, only the activation component is required, suggesting an increased planning time requirement to tell a lie compared with the truth (Walczyk et al., 2003).

Only a limited number of studies have examined the relation between these executive functioning skills and deception. Carlson et al. (1998) found support for the relation between inhibitory control and deception by demonstrating that 3-year-olds who had difficulty with inhibitory control had difficulty deceiving someone by pointing to the wrong location of a hidden object. More recently, Talwar and Lee (2008) built on Carlson et al.'s findings by assessing 3- to 8-year-olds' lie-telling behaviors and found that children's ability to deny their transgression was related to their inhibitory control skills. Additionally, Evans et al. (2011) examined 4-year-olds' ability to strategically lie by maintaining consistency between the physical evidence of their transgression (candies they spilled from a cup on the table after being told to not touch the cup) and their verbal statements. Results revealed that children's inhibitory control skills were significantly related to their ability to maintain consistency between the physical evidence and their deceptive statements. Taken together, these studies provide support for the relation between inhibitory control skills and lie-telling behaviors in young children. A similar relation between inhibitory control skills and lying may be found during late childhood into adolescence. However, developmental studies have shown that inhibitory control abilities have a long course of development that begins in the preschool years and continues well into adolescence (e.g., Bunge, Dudukovic, Thomason, Vaidya, & Gabrieli, 2002; Durston et al., 2002; Williams, Ponesse, Schachar, Logan, & Tannock, 1999). Thus, with the continued development of inhibitory control skills, the relation to lie telling may change. Perhaps whereas younger children require inhibitory control skills when making their initial denial, older children rely on such skills for more complex tasks that are cognitively taxing, such as making additional statements to continue the concealment of their deception during follow-up questioning. The relation between inhibitory control and lie telling during late childhood and into middle adolescence was therefore tested in the present study.

Support for a relation between working memory and lying has been inconsistent. Talwar and Lee (2008) found no significant relation between young children's performance on the six-box scramble working memory measure and lie telling. However, they found that the Stroop task, which has been suggested to involve both inhibitory control skills and working memory (see Carlson & Moses, 2001; Evans et al., 2011; Talwar & Lee, 2008), was significantly related to children's lie telling. These results suggest that there may be a relation between working memory and lie telling, particularly when in conjunction with inhibitory control. Another possibility is that with the development of working memory skills, and the increased ability to apply such skills to a deceptive task, a relation may be found in early to middle adolescence.

Only one study has examined the relation between planning skills and lying with children (Evans et al., 2011) and found no relation between the two. One possible explanation for the lack of relation between planning and young children's lie-telling behavior is that the kind of lying involved in these studies was typically simple denials of transgression (e.g., "I didn't do it") or denials of knowledge (e.g., "I don't know"). The need to plan in these situations might be rather limited. However, in situations where simple denials are no longer enough, lie tellers may need to resort to their planning abilities to produce convincing lies. Consequently, a significant relation between planning skills and lying may emerge. Another possibility is that perhaps Evans et al. (2011) were measuring the wrong aspect of planning in relation to deception. Rather than planning ability, it may be that the time it takes to plan a response is more relevant, as suggested by the ADCM (Walczyk et al., 2003). Indeed previous research with adults has found a relation between the veracity of a statement and response times such that dishonest responses tend to take longer than honest responses

(DePaulo et al., 2003; Spence et al., 2001; Walczyk et al., 2003, 2005). The present study investigated this possibility by examining the relation between planning time and deceptive abilities from late childhood into middle adolescence.

To extend our understanding of the development of deception to late childhood and middle adolescence, we used a modified temptation resistance paradigm based on Talwar et al. (2007). In this modified paradigm, 8- to 16-year-olds were left alone in a room with the answers to a test and told not to peek at the answers. Upon returning to the room, participants were asked whether they peeked at the test answers. In addition, we asked participants follow-up questions to assess the sophistication of their lies by examining their ability to maintain consistency between their initial lie and the subsequent statements. Three forms of executive functioning were examined in this investigation: inhibitory control (Word–Color Stroop), working memory (Digit Span Backwards), and planning skills (Tower of London). The Word–Color Stroop, Digit Span Backwards, and Tower of London tasks were selected for several reasons. First, all three tasks are standardized for the age range of 8–16 years. Second, we attempted to select tasks that most specifically measured the desired executive functioning skill so that that the interpretation of the relation between the task and deception could be more clearly interpreted. Finally, tasks were selected that were not too similar in nature to the deception task itself so that relations between the measures were not a result of simply measuring the same construct.

Our first goal was to examine whether 8- to 16-year-olds would lie to conceal their transgression of peeking at the answers to a test. On the basis of previous self-report studies in late childhood through adolescence, it was predicted that lie-telling rates may decrease with age (Hypothesis 1; Jensen et al., 2004; Stouthamer-Loeber & Loeber, 1986). Additionally, we examined a significant relation between executive functioning skills and the decision to tell a lie. Whereas previous findings with younger children have been mixed in terms of the relation between the decision to lie and executive functioning skills (Carlson et al., 1998; Talwar & Lee, 2008; also see Evans et al., 2011), our predictions were made based on the ADCM of deception (Walczyk et al., 2003). Specifically, it was predicted that participants who told a lie would have better working memory and inhibitory control skills, as working memory is required to hold the activated memory of the truth, whereas inhibitory control is required to inhibit telling the truth (Hypothesis 2). Given that only a simple “yes” or “no” response was required for the initial denial, planning time was not predicted to be related to the initial decision to lie.

Our second goal was to examine the sophistication of the ability to lie from late childhood through middle adolescence. It was predicted that with growth in cognitive skills during the developmental period (e.g., Bunge et al., 2002; Durston et al., 2002; Williams et al., 1999), there would be an increase in the sophistication of participants’ lies (Hypothesis 3; Carlson & Moses, 2001; Evans et al., 2011; Talwar & Lee, 2008). Predictions were made for each of the individual executive functioning scores. First, 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 participants must inhibit the truth (e.g., reporting they peeked at the answers) while reporting false information (Hypothesis 3A; Evans et al., 2011; Talwar et al., 2008). Second, it was predicted that those with better working memory skills would tell more sophisticated lies, as participants would have to activate and hold in memory the truthful knowledge while creating the alternative response (Hypothesis 3B; Walczyk et al., 2003). Finally, in line with the ADCM, it was predicted that those who developed more sophisticated deceptive responses would require increased planning time (Walczyk et al., 2003). Thus, it was expected that those who took their time planning (higher planning time scores on the Tower of London) would tell more sophisticated lies (Hypothesis 3C).

Method

Participants

One hundred and eight 8- to 16-year-olds participated in the present study, including thirty-three 8- to 10-year-olds (18 boys, 15 girls; mean age = 9.36 years, *SD* = 0.60), forty-one 11- to 13-year-olds (22 boys, 19 girls; mean age = 11.90 years, *SD* = 0.80), and thirty-four 14- to 16-year-olds (18 boys, 16 girls; mean age = 14.91 years, *SD* = 0.83). Late adolescence was not examined in the present investigation. For all analyses, age was used as a continuous variable. All participants were recruited through advertisements from a major Canadian city and were of middle socioeconomic status. Forty-three percent of participants were self-identified Caucasian (*N* = 46), 22% were Asian (*N* = 24), 17% were African Canadian (*N* = 18), 1% were Hispanic (*N* = 1), and 18% were of unidentified races (*N* = 19). Informed consent was obtained from all parents prior to beginning the study, and oral assent was obtained from all participants.

Design and Procedure

Participants were individually tested in a quiet room with the researcher and were asked to complete a trivia-style test designed to assess their general knowledge about the world. They were told that there were 10 questions and, as extra motivation to do well, if they answered all 10 questions correct, they would receive $10, but if they incorrectly answered even one question, they would not receive the money. The trivia task booklet included 10 trivia questions placed on the front page (e.g., “How many musicians are in a trio?”). Unknown to the participants, two of the 10 questions had no correct answers (“Who invented the hairbrush?” and “Who discovered Tunisia?”), with the purpose of motivating participants to peek at the test answers. The answers for each question were listed in numerical order on the inside of the booklet. Fabricated answers were inserted for the two no-answer questions (“Jones” and “Nelson,” respectively). Participants were instructed not to look at the answers on the inside of the booklet and told to retrieve the researcher when they had completed the task.

While the researcher was in the waiting room, four hidden cameras recorded whether participants peeked at the answers to the test. As there were 10 questions, participants often peeked at the answers multiple times. The number of peeks was counted live by a second researcher in a closed control room. Those participants who looked at the answers were classified as *peekers*, and those who did not look were classified as *nonpeekers*. Once the participants completed the test, they retrieved the researcher from the waiting room. Prior to taking up the answers to the test, the researcher, who was blind to whether the participants had peeked at the answers, asked the target question, “While I was gone out of the room, did you peek at any of the answers to the test?” This question is henceforth referred to as the Time 1 target question. Peekers’ responses were coded into one of two categories. If they peeked at the answers and said “yes” in response to the target questions, they were classified as *truth tellers*. If they peeked at the answers and said “no” in response to the target question, they were classified as *lie tellers*.

Inside the testing booklet, “*H* ♥ 8” had been printed to the right of each answer. After receiving their total score on the test, the researcher told participants that they had a bonus question for them. Participants were told that this question was not worth any money but that the researcher just wanted to see whether they could get it correct. Participants were then told that a letter, a shape, and a number were listed on the inside and were asked what they were (i.e., “There is a letter, shape, and number on the inside of this booklet. What are they?”). Given that the question was phrased as a “bonus question,” participants did not appear to be suspicious of such a question after being asked not to peek at the test answers.

This letter, shape, and number question was used to assess the sophistication of participants' ability to lie, because they ought not to know the answer to this question unless they peeked at the answers. Thus, those who gave correct answers to this question would reveal the fact that they had peeked. To conceal transgression, one should feign ignorance by giving inaccurate answers to all three items, or at least some of them (particularly given that the question is not worth any money). Participants were given 1 point for each correct item they identified and received a total Letter–Shape–Number score ranging from 0 to 3. The lower the score, the better the participant was at concealing incriminating knowledge he or she ought not to know.

However, it is possible that inaccurate answers to the Letter–Shape–Number question might be due to the fact that participants who peeked were so focused on the test answers that they did not notice the letter, shape, and number next to the answers. To ensure that this was not the case, all participants were given a control trivia task that was completed with the same researcher. Participants were told that for this task we were looking at how people learn information and that they would be asked a question and if they did not know the answer they would be given 3 s to learn the answer by reading it on the inside of the testing booklet. The control trivia task booklet, formatted identically to the trivia task booklet, included five extremely difficult trivia questions placed on the front page (e.g., "What year was the smoke detector invented in?"). Fabricated answers to each question were listed in numerical order on the inside of the control trivia task booklet. All answers were fabricated to ensure that participants could not "correctly" answer the questions based on their own knowledge and would need to look inside the booklet to get the correct answer. In addition, a letter, a shape, and a number ("*W* ☺ 4") were printed to the right of each answer.

To control for the amount of time participants spent looking at the answers, we yoked the number of times participants looked inside the control trivia task booklet with the number of times they peeked at the trivia test answers up to a maximum of five peeks. After completing the corresponding yoked number of peeks, participants were told that there were a letter, shape, and number listed on the inside of the booklet and that the researcher wanted to see whether they could correctly name them. Participants were told this question was not worth any money and were then asked to name the letter, shape, and number (Control Letter–Shape–Number question). Given that participants were instructed by the researcher to look inside the booklet, no transgression had transpired, and there was no need for participants to conceal their knowledge of the letter, shape, and number. Thus, this task simply revealed whether participants could accurately remember the letter, shape, and number while reading the test answers. Participants were given 1 point for each correct answer to the Control Letter–Shape–Number question. All Control Letter–Shape–Number scores ranged from 0 to 3. The higher the Control Letter–Shape–Number score, the better participants were at remembering the letter, shape, and number while reading test answers.

After completing the control trivia task, participants were asked to promise to tell the truth for the next question the researcher asked. All participants promised to tell the truth, and then the researcher asked the target question again, "While I was gone out of the room, did you peek at the answers to the test?" This question is henceforth referred to as the Time 2 target question. Responses to this question were coded on the same criteria as the Time 1 target question.

Finally, all participants completed three executive functioning measures: Digit Span Backwards, Word–Color Stroop, and Tower of London. The Digit Span Backwards subtest from the Wechsler Intelligence Scale for Children–Fourth Edition was used to assess participants' working memory (a system for temporarily holding and processing information in the mind; Baddeley, 1986). Participants were given strings of numbers and were asked to repeat the series in reverse order. One point was awarded for each string of digits recalled correctly. Participants' scores for both the total number of strings correct (Digit Span Backwards: ranging from 0 to 16) and the longest string of digits recalled backwards (Longest Digit Span Backwards: ranging from 0 to 8) were converted into *z* scores and summed to create a total Digits Backwards working memory score.

To examine participants' inhibitory control skills, or an individual's ability to suppress a response or behavior while completing a separate goal, we administered the Word–Color Stroop. First, participants were presented with a page with the words *RED*, *BLUE*, and *GREEN* written in black ink repeatedly in random order and asked to read as many words as possible in 45 s (Word trial). Then, participants were presented with *XXX* written in blue, red, or green ink repeatedly in random order and asked to name the colors of ink as fast as possible in 45 s (Color trial). Finally, participants were presented with words written in a contrasting color and asked to name the color of the ink and ignore the word (Word–Color trial). An interference score was calculated by subtracting the total number of words read on the Word trial from the total number of items on the Word–Color trial.

To evaluate participants' executive planning (the process of formulating, evaluating, and selecting a sequence of thoughts or actions to achieve a desired goal), we administered the Tower of London–Drexel University–Second Edition. The test consists of two identical boards, each consisting of three pegs and three different-colored beads. The researcher created a pattern with the bead on one peg board, and participants were asked to move the beads on the corresponding board to create the same pattern as the researcher in as few moves as possible. Participants' scores for the amount of time it took to solve the problem (execution time) and the number of times they took longer than 1 min to complete each trial (total time violations) were converted into *z* scores and summed to create a measure of executive planning time. The order of the three executive functioning tasks was randomized between participants.

Upon completion of the 30-min testing session, participants were debriefed with their parents and discussed issues regarding truth and lie telling. All participants received the $10 for participating in the study regardless of their performance on the test.

Results

Preliminary results revealed no significant effects of gender. Thus, the results for both genders were collapsed for all subsequent analyses. Additionally, preliminary analyses revealed no significant interactions between age and each of the executive functioning skills. Thus, these interactions were removed from all future analyses.

Peeking Behavior

Approximately 54% of participants (58 out of 108) peeked at the answers to the test while the researcher was gone. A logistic regression was performed with age in years (continuous variable) entered on the first step and peeking behavior (1 = peeked, 0 = did not peek) as the predicted variable. The model was significant, $\chi^2(1, 108) = 7.45$, Nagelkerke $R^2 = .09$, $p < .05$, indicating that as age increased, participants were significantly less likely to peek ($\beta = -.24$, $Wald = 6.98$, $p < .05$, $OR = 1.28$; see Figure 1). Specifically, the odds ratio (*OR*) indicates that for each year increase in age, participants were 1.28 times less likely to peek.

Lie-Telling Behavior and Its Relation to Executive Functioning Skills (Hypotheses 1 and 2)

Lie-telling behaviors at Time 1—Of the 58 participants who peeked at the answers to the test, approximately 84% lied ($N = 49$) and 16% told the truth ($N = 9$). A logistic regression was performed with lie telling at Time 1 as the predicted variable (0 = truth, 1 = lie). Age in years (continuous variable) was entered on the first step, followed by all three of the executive functioning scores (Digits Backwards, Stroop, Tower of London) on the second step. The first model with age in years was significant, $\chi^2(1, 58) = 6.86$, Nagelkerke $R^2 = .30$, $p < .05$, indicating that as age increased, participants were significantly more likely to tell the truth rather than lie ($\beta = -.46$, *Wald* = 5.91, $p < .05$, *OR* = 1.59, see Figure 2). Specifically, supporting Hypothesis 1, the odds ratio indicates that for each year increase in age, participants were 1.59 times more likely to confess that they peeked. The second step of the model including all the executive functioning skills was not significant, indicating that in contrast to Hypothesis 2, none of the executive functioning measures were related to participants' decision to tell the truth or tell a lie at Time 1.

Lie-telling behaviors at Time 2—Of the 58 peekers, 65% (*N* = 38) continued to lie and 34% (*N* = 20) told the truth at Time 2. A logistic regression was performed with lie telling at Time 2 as the predicted variable (0 = truth, 1 = lie). Age in years (continuous variable) was entered on the first step, followed by all three of the executive functioning scores (Digits Backwards, Stroop, Tower of London) on the second step. Again, the first model with age was significant, $\chi^2(1, 58) = 5.47$, Nagelkerke $R^2 = .13$, $p < .05$, indicating that as age increased, participants were significantly more likely to tell the truth rather than lie ($\beta = -.32$, *Wald* = 5.03, $p < .05$, *OR* = 1.37, see Figure 2). Specifically, the odds ratio indicates that for each year increase in age, participants were 1.37 times more likely to confess that they peeked. In other words, with increased age they were significantly more likely to tell the truth, again in support of Hypothesis 1. The second step was not significant, indicating that in contrast to Hypothesis 2, none of the executive functioning measures were related to participants' decision to tell the truth or tell a lie at Time 2.

The Sophistication of Lies and Its Relation to Executive Functioning Skills (Hypothesis 3)

The sophistication of participants' lies was assessed in terms of their ability to maintain their lie by concealing incriminating knowledge they ought not to know (the letter, shape, and number on the inside of the trivia task booklet). To control for participants' memory ability, we created a difference score by subtracting participants' Letter–Shape–Number score from their Control Letter–Shape–Number. Prior to subtracting one from the other, *z* scores were created for both Letter–Shape–Number scores. Positive difference scores indicated that participants reported more correct responses to the Control Letter–Shape–Number question than the Letter–Shape–Number question (suggesting an ability to conceal incriminating knowledge). A difference score of 0 indicated that there was no difference in participants' performance on the two tasks, and negative difference scores indicated that participants performed better on the Letter–Shape–Number question than the Control Letter–Shape–Number question (suggesting failure to conceal incriminating knowledge).

Sophistication of lies at Time 1—We began by examining the difference scores for those participants who told lies at Time 1. A linear regression was performed with difference scores as the predicted variable. Age in years (continuous variable) was entered on the first step, followed by all three of the executive functioning scores (Digits Backwards, Stroop, Tower of London) on the second step (see Table 1 for correlations between the Digit Span Backwards, Longest Digit Span Backwards, Stroop interference score, Tower of London execution time, and Tower of London total time violations). The first model with age in years was not significant, $F(1, 47) = 0.03$, $p = .87$, $R^2 = .01$. However, after controlling for age, the second step was significant, $\Delta F(1, 44) = 4.61$, $p < .05$, $\Delta R^2 = .24$, suggesting that the three executive function measures together were related to participants' ability to feign ignorance of the incriminating information, supporting Hypothesis 3. When examining which executive functioning scores significantly contributed above and beyond all other common contributions in the model, only the Digits Backwards and Tower of London were significant. Specifically, for those participants who lied at Time 1, higher Digit Span (β = .46, $t = 3.21$, $p < .05$, part correlation = .42) and Tower of London scores (β = .28, $t = 2.02$, $p < .05$, part correlation = .27) were related to higher difference scores, indicating that participants with better working memory and those who took their time planning were better able to conceal incriminating knowledge they ought not to know (supporting Hypotheses 3B and 3C).

Sophistication of lies at Time 2—Next, the difference scores for only those participants who continued to lie at Time 2 were assessed. A linear regression was performed with difference scores as the predicted variable. Age in years (continuous variable) was entered on the first step, followed by all three of the executive functioning scores (Digits Backwards, Stroop, Tower of London) on the second step. The first model with age was not significant, $F(1, 35) = 0.34$, $p = .56$, $R^2 = .01$. However, after controlling for age, the second step was significant, $\Delta F(1, 32) = 4.91$, $p < .05$, $\Delta R^2 = .31$, suggesting that the three executive function measures together were related to participants' ability to feign ignorance of the incriminating information when asked a second time about their transgression (supporting Hypothesis 3). When assessing which individual executive functioning scores significantly contributed to the model above and beyond all other variables' contributions in the model, only Digit Span and Stroop interference scores were significant. Specifically, for those participants who lied at Time 2, higher Stroop interference (β = .34, $t = 2.14$, $p < .05$, part correlation = .31) and Digit Span (β = .40, $t = 2.51$, $p < .05$, part correlation = .37) scores were related to higher difference scores, indicating that participants with better inhibitory control and working memory skills were better able to conceal incriminating knowledge they ought not to know (supporting Hypotheses 3A and B).

Discussion

The present investigation assessed the development of deceptive behaviors from late childhood through middle adolescence. We aimed to examine the development of the decision to tell a lie, the sophistication of lies told, and their relation to cognitive factors. Results revealed several novel findings in terms of lie-telling behaviors and the relation between the sophistication of participants' verbal deceptive behaviors and their executive functioning skills.

The Decision to Lie

With regard to the decision to lie, we found that, consistent with previous findings with younger children (Polak & Harris, 1999; Talwar et al., 2007; Talwar & Lee, 2002, 2008), the majority of participants who peeked lied about their transgression. Whereas previous studies with younger children found that lie telling increased with age, consistent with Hypothesis 1, the present investigation revealed a decrease in lie telling from late childhood into middle adolescence. This developmental decrease in lie telling may be due to the fact that adolescents have more advanced moral knowledge of lying, which may have led them to confess their transgression (Lee & Ross, 1997). Another possible explanation for this developmental decrease in lie telling may be that adolescents, compared with children in late childhood, were more aware of the difficulty in successfully deceiving their potential lie recipient (in the present case, an adult) and, thus, told the truth to avoid being caught telling a lie. Future studies examining 8- to 16-year-olds' motivations and meta-cognitive understanding underlying their decision to tell the truth or a lie are needed to gain a better understanding of this developmental decrease.

Next, the relation between participants' decision to tell a lie and executive functioning skills was examined. In line with the ADCM of deception (Walczyk et al., 2003), it was predicted that participants who told a lie would have better working memory and inhibitory control skills, as working memory is required to hold the activated memory of the truth, whereas inhibitory control is required to inhibit telling the truth. However, the present investigation did not find a significant relation with any of the executive functioning measures and the decision to lie. To date, inconsistent results have been found with regard to executive functioning skills and the decision to lie. For example, Talwar and Lee (2008) found that 3- to 8-year-olds' decision to lie was positively related to inhibitory control skills. Conversely, Evans et al. (2011) failed to find a significant relation between inhibitory control skills and 4-year-olds' decisions to lie. One possible explanation for these inconsistent findings is that the decision to lie may not be solely driven by executive functioning skills. Situational factors may also influence whether someone decides to lie. For example, individuals' past experience with lying, or their perceptions of punishment if the transgression is revealed (Talwar & Lee, in press), may influence their decision to tell a lie.

The Sophistication of Lies

The development of the sophistication of lies from late childhood to middle adolescence was also assessed in terms of the ability to conceal incriminating knowledge participants ought not to know from peeking inside the testing booklet. It was predicted that with growth in cognitive skills during the developmental period (e.g., Bunge et al., 2002; Durston et al., 2002; Williams et al., 1999) there would be an increase in the sophistication of participants' lies (Carlson & Moses, 2001; Evans et al., 2011; Talwar & Lee, 2008). Additionally, it was predicted that those with better inhibitory control skills (Evans et al., 2011; Talwar & Lee, 2008) and working memory skills and those who took their time planning (Walczyk et al., 2003) would tell more sophisticated lies.

Although no significant age difference was found for the sophistication of lies, individual differences were revealed in relation to executive functioning skills. Overall, participants' scores on working memory, inhibitory control, and planning time together significantly predicted the sophistication of participants' ability to conceal their lies. Specifically, of the participants who told lies, those with better working memory were better able to conceal incriminating knowledge they ought not to know. In keeping with the ADCM, these participants may have been better able to hold in memory the truth and develop alternative responses resulting in greater sophistication in their deception. Also consistent with the predictions based on the ADCM, it was found that at Time 1 planning skills were related to the sophistication of lies. Specifically, those who took their time to plan their response tended to tell significantly more sophisticated lies. Thus, those participants who took the time during the planning task were better able to plan what incriminating information to conceal.

It is interesting to note that the sophistication of lies told by those who continued to lie at Time 2 was significantly related to their performance on the Stroop task. Specifically, participants with better performance on the Stroop were better able to conceal incriminating knowledge they ought not to know. This relation between Stroop scores and the sophistication of lies is consistent with previous findings with younger children and is the third time such a relation has been found (Evans et al., 2011; Talwar & Lee, 2008). It is worth noting that previous studies have not found a unique relation between other inhibitory control measures and the sophistication of lies (Evans et al., 2011; Talwar & Lee, 2008). However, unlike the other inhibitory control measures in previous studies, the Stroop task is thought to measure both inhibitory control and working memory. In the present situation, participants were required to hold in working memory what they knew about the letter, shape, and number next to the answers in order to create answers different from this knowledge. At the same time, they must inhibit reporting the correct answers. Taken together, these findings suggest that whether a person is a good lie teller or bad lie teller who is able to maintain his or her lie, is dependent on working memory in conjunction with inhibitory control. It is important to note that executive functioning scores together predicted the sophistication of lies at both Time 1 and Time 2. The differences in specific predictors at Time 1 compared with Time 2 were above and beyond the common contribution of all the executive functioning scores. Thus, in general, the importance of executive functioning in predicting the sophistication of lies at Time 1 and Time 2 is highly consistent.

In sum, the present investigation found support for the ADCM theory of deception. In support of the activation component of the ADCM, the present study demonstrates the relation between working memory and making deceptive statements. Additionally, the present investigation found support for the relation between planning time and verbal deception. Specifically, we found that sophisticated deceptive statements were related to longer planning times. In terms of the decision component of the ADCM, the present investigation did not find a significant relation between the initial decision of whether to lie and any of the executive functioning measures, thus failing to support the decision component of the ADCM. Thus, we failed to find support for the ADCM’s suggestion that inhibitory control skills are required to determine whether or not to lie, at least with 8- to 16-year-olds. However, it is important to note that the findings of the present investigation are correlational, and thus, future experimental studies in which the cognitive demands are manipulated are required to more fully examine these relations.

The findings of the present study help extend the developmental picture of the sophistication of lies told by young children to older children and adolescents. Previous studies with younger children indicate that the majority of children 5 years of age and younger fail to conceal their incriminating knowledge, thus revealing their transgression. As age increases between 6 and 11 years, the majority of children are able to successfully conceal their incriminating knowledge and, in turn, their transgression (Talwar & Lee, 2002, 2008). Further, the present study highlights the importance of individual differences in executive functioning skills during late childhood and adolescence in the ability to make sophisticated deceptive statements.

Executive functioning skills appear to begin playing a role in the decision to lie around 3 years of age. In particular, performance on the Stroop task is important because inhibitory control, in conjunction with working memory, is central to the decision to lie at younger ages (Talwar & Lee, 2008) and to the sophistication of lies told between 3 and 16 years of age (Evans et al., 2011; Talwar, & Lee, 2008). Additionally, the present investigation demonstrates that between 8 and 16 years of age, planning skills appear to be important for telling sophisticated lies. However, a similar paradigm in which 3- to 8-year-olds are given the opportunity to plan their deceptive responses before they are questioned is required to assess whether planning may also be important for younger children or whether the importance of planning is unique to late childhood and adolescence.

This knowledge about normative development may now be used to evaluate the atypical development of deception. Previous studies have suggested a link between such behavioral issues and deficits in executive functioning skills (e.g., Wåhlstedt, Thorell, & Bohlin, 2008). It is perhaps due to the deficit in executive functioning that these individuals fail to construct sophisticated statements that adequately conceal their transgression and deception, resulting in high rates of deception detection from others. Future studies assessing the relation between executive functioning, the sophistication of lies, and detection rates with atypically developing populations are needed to further address this intriguing possibility. Salekin, Kubak, and Lee (2008) proposed a model for examining deception in children and adolescence by examining multiple chief childhood variables. Specifically, they suggested that the developmental status and personality of the deceiver, whether there is any psychopathology, and the context of the deception should be considered when determining whether the deceptive statement is adaptive or maladaptive. Although the present investigation focuses on typically developing children in a single scenario, it would be informative in future studies to examine different youth populations, different contexts, and different developmental statuses to more completely inform different trajectories regarding the development of lie-telling behaviors.

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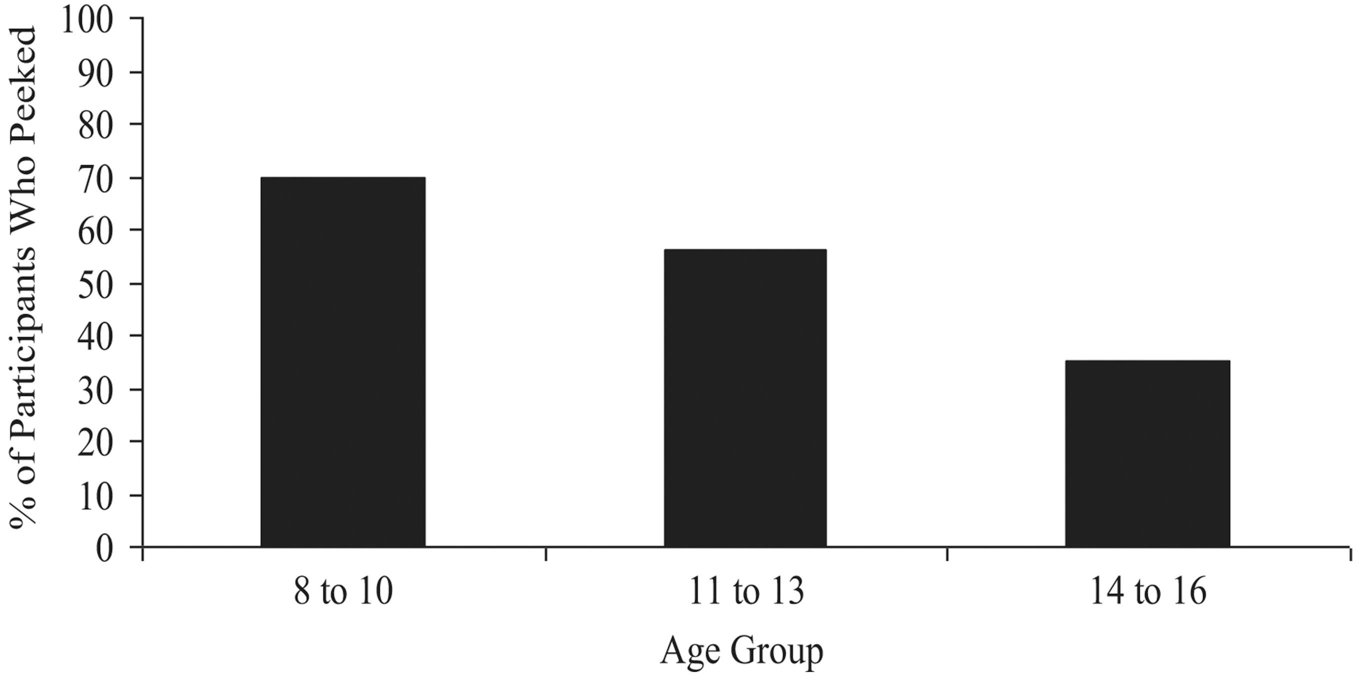

Figure 1.
Percentage of participants who peeked at the test answers by age group.

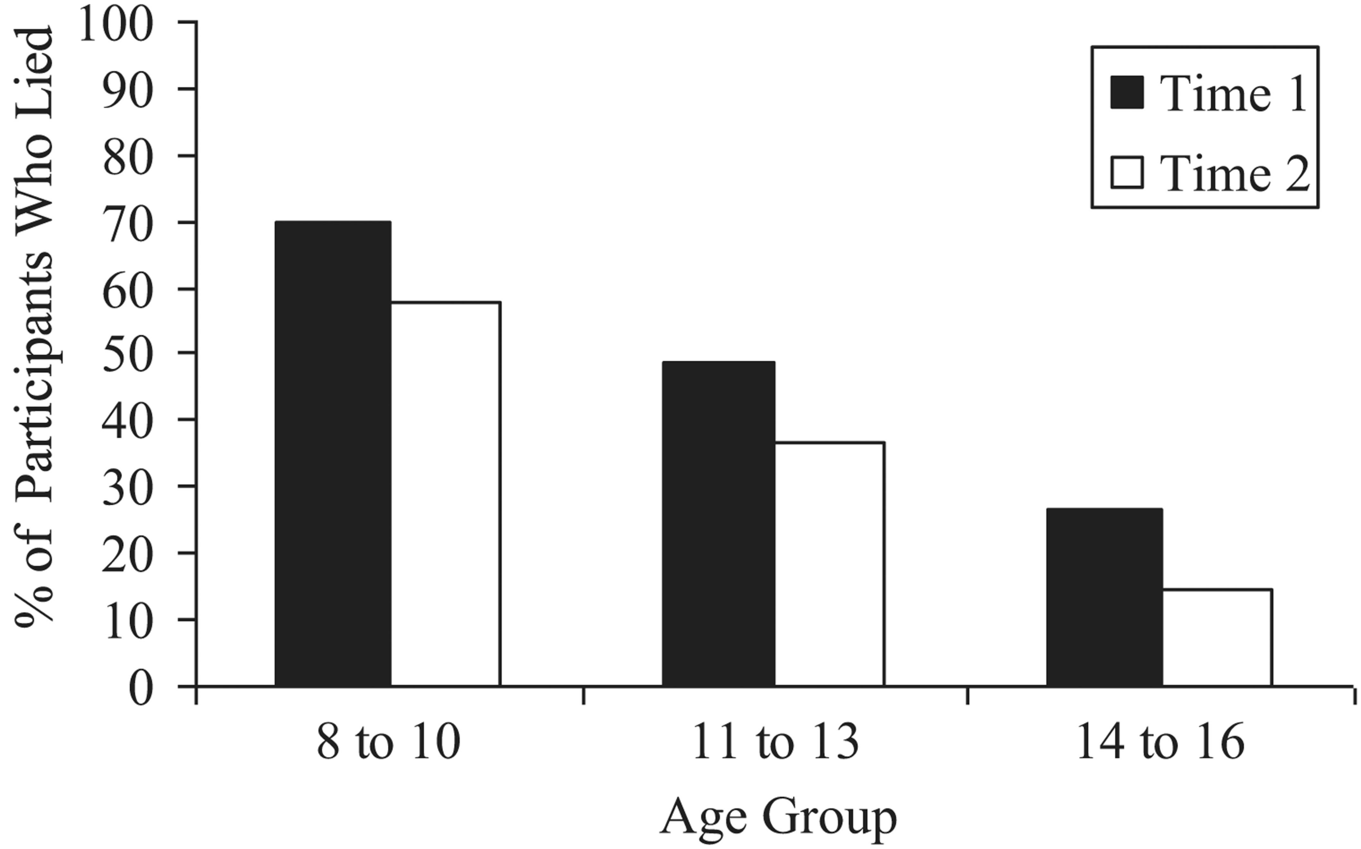

Figure 2.
Percentage of participants who lied about peeking at the test answers at Time 1 and Time 2 by age group.

Table 1

Correlations Between Raw Executive Functioning Scores by Age

Executive functioning score	1	2	3	4	5
8- to 10-year-olds					
1. DSB	—				
2. LDSB	.80**	—			
3. Stroop interference	.16	.24	—		
4. TOL execution time	−.17	−.15	−.10	—	
5. TOL time violations	−.12	−.92	−.39	.93**	—
11- to 13-year-olds					
1. DSB	—				
2. LDSB	.75**	—			
3. Stroop interference	.14	.12	—		
4. TOL execution time	−.27	−.34*	−.31	—	
5. TOL time violations	−.06	−.15	−.15	.78**	—
14- to 16-year-olds					
1. DSB	—				
2. LDSB	.91**	—			
3. Stroop interference	.07	.21	—		
4. TOL execution time	−.09	−.01	.04	—	
5. TOL time violations	−.01	−.05	−.01	.76**	—

Note. DSB = Digit Span Backwards; LDSB = Longest Digit Span Backwards; TOL = Tower of London.

* $p < .01$.

** $p < .001$.