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61. The Relation Between Young Children's False Statements and Response Latency, Executive Functioning, and Truth–Lie Understanding.

Shanna Williams, *University of Southern California Law*
Elizabeth C Ahern, *University of Cambridge*
Thomas D. Lyon

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Shanna Williams *University of Southern California*
Elizabeth Ahern *University of Cambridge*
Thomas D. Lyon *University of Southern California*

This study examined relations between children's false statements and response latency, executive functioning, and truth–lie understanding in order to understand what underlies children's emerging ability to make false statements. A total of 158 (2- to 5-year-old) children earned prizes for claiming that they were looking at birds even when presented with images of fish. Children were asked recall ("What do you have?"), recognition ("Do you have a bird/fish?"), and outcome ("Did you win/lose?") questions. Response latencies were greater when children were presented with fish pictures than bird pictures, particularly when they were asked recall questions, and were greater for false statements than for true statements, again when children were asked recall questions. Older but not younger children exhibited longer latencies when making false responses to outcome questions, which suggests that younger children were providing impulsive desire-based responses to the outcome questions. Executive functioning, as measured by the Stroop task, was not related to false statements. Children who were better at labeling statements as the truth or not the truth were more proficient at making false statements. The results support the proposition that the cognitive effort required for making false statements depends on the types of questions asked.

The development of children's lie-telling abilities is an active research area. An important question is how and at what age children acquire the

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Shanna Williams and Thomas D. Lyon, School of Law; and Elizabeth C. Ahern, Department of Psychology.

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Address correspondence to Shanna Williams, School of Law, University of Southern California, 699 Exposition Boulevard, Los Angeles, CA 90089. Phone: (213) 821-5599. E-mail: swilliams@law.usc.edu.

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ability to lie (Ahern, Lyon, & Quas, 2011; Lewis, Stranger, & Sullivan, 1989). Naturalistic observations have suggested that lying first emerges at 2 years of age (Wilson, Smith, & Ross, 2003). Laboratory work similarly finds that lie-telling begins as early as 2–3 years of age (Evans & Lee, 2013; Fu, Evans, Xu, & Lee, 2012; Leduc, Williams, Gomez-Garibello, & Talwar, 2017). By 4 years of age, the majority of children will tell simple lies to avoid punishment or discovery of a misdeed (Fu et al., 2012; Lee, 2013; Talwar & Lee, 2002).

A long-standing debate concerns whether children's earliest lies can be characterized as assertions of fact as opposed to expressions of desire (Stern & Stern, 1909). An essential element of a lie is a knowingly false statement. Ahern and colleagues (2011) found that children as young as 2½ were capable of making false statements, but found performance varied across question types. The authors argued that the youngest children were most adept at making false statements when they could reference their desires rather than their beliefs.

This study more closely examined children's responses in the Ahern et al. study (2011), assessing the relation between children's false statements in response to different question types and response latency, executive functioning (a measure of working memory and inhibitory control), and children's incipient ability to label true and false statements as the truth and lies. The goal was to better understand the extent to which generating false statements requires greater cognitive effort than do true statements. In what follows, we review research relevant to understanding the nature of children's earliest lies, the possible role of cognitive effort and response latency as a means of measuring effort, and the relation between lie-telling and both executive functioning and truth–lie understanding.

Children's Early Lies

Many of children's early lies might be expressions of desire rather than assertions of fact. Children's use of "no" first emerges as a reflection of the child's desires rather than a negation of a factual assertion (Hummer, Wimmer, & Antes, 1993; Pea, 1980). In their classic work, Stern and Stern (1909) proposed that children's earliest lies should be called pseudo-lies and include "momentary impulsive utterances" (pp. 111–112). Observing children's early use of "no" when accused of wrongdoing, the Stern's argued that "a considerable time must pass before the 'no' that is originally used in a purely affective way can be understood or used at all in a way that expresses a declaration of meaning" (p. 106). Subsequent researchers have noted that children's early lies might be characterized as "affective responses" (Sodian, 1991) or as wish fulfillment (Talwar & Lee, 2008).

Elaborating on this idea, Ahern et al. (2011) argued that children's responses to questions can be desire-based or belief-based. For example, if a child is asked if he or she was naughty, a "no" could mean "I don't want" or "I don't like" to be naughty (desire-based), or it could mean "I wasn't" naughty (belief-based). They argued that desire-based responses were more likely if questions referred to desirability rather than factuality and if questions permitted children to accept or reject information rather than independently generate information. Ahern and colleagues (2011) taught 2½- to 5½-year-old children a game in which they earned prizes for claiming every picture they were shown was a bird, and then showed them pictures, some fish and some birds. The questions varied whether children's attention was drawn to the truth (recall: "What do you have?" and recognition: "Do you have a bird/fish?") or to their desire (outcome: "Do you win/lose?"), and whether children had to generate information (recall) or merely affirm or deny information (recognition). They found that the youngest children were most proficient at responding to the outcome questions (claiming falsely that they had won), and there was some evidence that children were more adept at merely affirming false information or denying true information (recognition questions) than at generating false information (recall questions).

Cognitive Effort and False Statements

A classic argument in experimental psychology is that lying is more difficult than truth-telling and, as such, takes more time (Goldstein, 1923). For example, one cognitive model of lying, the Activation–Decision–Construction–Action Theory of deception (Walczyk, Harris, Duck, & Mulay, 2014), proposes that lying is more cognitively demanding than truth-telling because liars initially retrieve the truth, decide to lie, and then construct a lie. Early meta-analyses, however, found little evidence that adult liars in general exhibited longer response latencies than truth-tellers (Depaulo et al., 2003; Zuckerman, Koestner, & Driver, 1981). Nevertheless, there was evidence that some types of lying did in fact show longer latencies, such as unplanned lies and lies about transgressions (Depaulo et al., 2003; see also Vrij, 2008). More recent meta-analyses have found longer response latencies for lies (Sporer & Schwandt, 2006; Suchotzki, Verschuere, Van Bockstaele, Ben-Shakhar, & Crombez, 2017), in part because of greater precision in measuring latencies.

The relation between response latencies and lying may vary depending on the types of questions asked. Recall generally requires more cognitive effort than recognition because in recall one must generate the to-be-remembered information whereas in recognition the to-be-remembered information is provided by the question (Vrij, Mann, & Fisher, 2006). Therefore, when individuals lie in response to a recall question, they must suppress their truthful response while retrieving the lie. In contrast, when children lie in response to recognition questions, they do not need to retrieve the lie, as it is cued by the question. As a result, the relative difficulty of lying versus telling the truth may be greater in response to recall questions than in response to recognition questions (Walczyk, Roper, Seemann, & Humphrey, 2003).

Outcome questions (e.g., "Did you win/lose?") present a more difficult case. They are a type of recognition question because they only require a yes or no response. However, they arguably require more cognitive effort because both true and false statements require an extra step—one has to coordinate recognition of the stimulus (bird or fish) with the rules of the game (bird wins, fish loses). On the other hand, they provide an opportunity for pseudo-lies, because winning is obviously desirable and losing is obviously undesirable. Therefore, false outcome responses should take longer than true outcome responses only if the child's reaction is not short-circuited by an impulsive resort to a desire-based response. Hence, younger children, being more impulsive (Carlson, Mandell, & Williams, 2004), may perform well on the outcome questions and not exhibit longer response times to false responses (claiming that they won when they were shown a fish). Older children may reflect more closely on the rules of the game, inhibit a desire-based response, and then produce a response that is false but also conscious of the rules.

Executive Functioning and False Statements

False claim performance may also be related to executive functioning skills, which are higher-order processes involved in goal-oriented behavior (Zelazo & Müller, 2002). A number of researchers have explored the relation between children's lie-telling proficiency and measures of executive functioning (Evans & Lee, 2013; Evans, Xu, & Lee, 2011; Leduc et al., 2017; Talwar & Lee, 2008).

For example, some research has found a positive relation between lying proficiency and Stroop tasks, including the shape task (2- to 3- year-olds; Evans & Lee, 2013) and the day–night task (3- to 8-year-olds; Talwar & Lee, 2008). Stroop tasks assess inhibitory control and working memory.

Inhibitory control is the ability to suppress prepotent responses (McCall, 1994). *Working memory* is the ability to maintain information in mind (Baddeley, 1992). In the day–night task, children are taught that if they are shown a picture of a sun, they should say "night," and if they are shown a picture of a moon, they should say "day." The task burdens inhibitory skills because children must inhibit prepotent responses—namely, to utter the natural associates of the sun (day) and the moon (night). The task burdens working memory because the child has to keep in mind the rule (if sun, then night; and, if moon, then day) and produce the desired response. Researchers have argued that lying implicates inhibitory skills because the liar has to inhibit responding honestly, and working memory because the liar needs to hold in mind the truth while generating the lie (Talwar & Lee, 2008).

As with measures of cognitive effort, the relation between executive functioning and lying may vary depending on the kinds of questions asked and other aspects of the task. The research finding a relation between executive functioning and lie proficiency has primarily focused on lies told in response to recognition questions about a prohibited behavior ("Did you peek?") (Evans & Lee, 2013; Talwar & Lee, 2008). On the one hand, the task is quite demanding insofar as children who successfully deceive must recall the prohibition (in addition to their behavior), decide to answer deceptively, and provide a deceptive response. On the other hand, recognition questions may facilitate deception because the child can simply respond "no," as opposed to recall questions, in which the child must generate information. Outcome questions again present a mixed case, as described earlier with respect to cognitive effort.

Truth–Lie Recognition and False Statements

From a legal perspective, children who are too young to recognize the difference between truthful and deceptive statements are often found incompetent to testify (Lyon, 2011). From a developmental perspective, this is curious, because research has found that children develop the ability to recognize true statements as the "truth" and false statements as "a lie" during the preschool years (Bussey, 1992; Lyon, Quas, & Carrick, 2012), at the same time that they are becoming proficient at making false statements (Ahern et al., 2011).

Research examining the relation between children's truth–lie identification ability and lie-telling has found mixed results: Talwar and Lee (2008) found no relation among 3- to 8-year-olds; Talwar, Lee, Bala, and Lindsay (2002) found either no relation (Studies 1 and 3) or a positive relation between understanding and lying (Study 2) in 3- to 7-year-olds;

and Talwar, Lee, Bala, and Lindsay (2004) found no relation among 3- to 11-year-olds. However, none of this research focused on younger children. More recently, Williams, Leduc, Crossman, and Talwar (2017) found a positive relation between understanding and lying in 2- to 3-year year olds. Specifically, the researchers found that children who told lies during the temptation resistance paradigm were also more likely to identify lies as such on the truth–lie recognition task (Lyon et al., 2012). Hence, to the extent that a relation exists, children with better understanding of the meaning of truth and lie appear more inclined to lie.

The Current Study

The current study analyzed Ahern et al.'s (2011) sample of 2½- to 5½-year-olds for response latencies and correlations with executive functioning and truth–lie understanding tasks. For the false statement task children were taught to say they had a bird regardless of whether they were presented with pictures of birds or fish. Children were asked recall, recognition, and outcome questions. Children's response time to the different questions (i.e., recall, recognition, and outcome) was measured. Children also completed a day–night Stroop task and a truth–lie identification task. For the current study, we examined children's response latency to bird pictures compared to fish pictures. In order to succeed at the task, children would utter true statements in response to the bird pictures and false statements in response to the fish pictures.

We made a number of predictions. Based on Ahern and colleagues' (2011) findings regarding young children's difficulty with making false statements, we predicted that children would take longer to respond to fish pictures (since they required a false statement to succeed at the task) (Hypothesis 1). Because of the greater cognitive demand of recall questions, we predicted that the difference would be most pronounced for recall (Hypothesis 2). We also predicted that response latencies would be longer for false statements than for true statements (Hypothesis 3). However, we predicted that at least for the younger children, because they could impulsively give desire-based responses to the outcome questions that were false (they could impulsively claim that they won when they had a fish picture), their latencies for true and false outcome statements would not differ (Hypothesis 4).

We were also interested in children's false statement production in relation to executive functioning and truth–lie understanding. Children's lie-telling has been linked to executive functioning, particularly Stroop tasks (Evans & Lee, 2013; Talwar & Lee, 2008). We thus expected false statement success to correlate positively with performance on the day–night Stroop task (Hypothesis 5). Some research has found that children's lying proficiency is positively related to their ability to recognize truth and lies (Williams et al., 2017). We thus predicted that children's false statement success would be positively related to their ability to identify truth and lies (Hypothesis 6).

Method

Participants

A total of 158 children (44% girls, *n* = 70) between the ages of 2 years, 7 months, to 5 years, 7 months (*M* = 49 months, *SD* = 8.5) from predominantly middle-class neighborhoods in Southern California participated in the study (Ahern et al., 2011). Because the researchers predicted emergence of understanding among older 3-year-olds, children were divided into three age groups. In the youngest age group (range = 2 years, 7 months, to 3 years, 6 months; *M*age = 25 months, *SD* = .42) were 41 children (44% girls); in the middle age group (range = 3 years, 7 months, to 4 years, 6 months; *M*age = 37 months, *SD* = .48) were 69 children (42% girls); and in the oldest age group (range = 4 years, 7 months, to 5 years, 7 months; *M*age = 48 months, *SD* = .48) were 45 children (50% girls). The sample ethnic breakdown was 56% Caucasian, 13% Asian, 10% Latino, 3% African American, and 18% biracial/other/unknown.

An institutional review board approved the study to be conducted with human subjects (i.e., minors with parent consent). We obtained written consent from parents through in-person recruitment. Informed consent was obtained from all parents and assent from children prior to involvement in the study.

Materials and Procedure

Children were individually brought to a quiet area of their preschool, where the experimenter obtained their assent to participate. Children completed the false statement task (Ahern et al., 2011), truth–lie identification (Lyon et al., 2012), and the day–night Stroop task (Gerstadt, Hong, & Diamond, 1994). The truth–lie identification task was administered either first or last, and the false statement task was administered in between. Task administration order did not affect children's performance and is not discussed further.

False statement task. The experimenter introduced the task by instructing children to claim that they always had a bird, regardless of what type of picture the experimenter showed the child (i.e., bird or fish). The experimenter said, “If you say you have a bird, you win and you get a prize!” The experimenter then demonstrated winning by placing a play coin inside a box. The experimenter then said, “But if you don’t say you have a bird, you lose, and I take away your prize!” The experimenter then demonstrated losing by taking the coin out of the box.

The experimenter then conducted six practice trials. During practice trials, the experimenter showed children pictures of fish, encouraged them to claim that they were birds, and placed or removed coins. After training, the game rule was reiterated and testing began. During test trials, children were shown three blocks of six fish pictures and one block of six bird pictures. The order of the block of bird pictures was counterbalanced across children. The design used more fish pictures than bird pictures in order to provide children more opportunities to utter false statements, with the anticipation that they would have little difficulty labeling bird pictures as such.

Children were asked only one question per picture. The questions included recall (“What do you have?”), recognition (“Do you have a bird/fish?”), outcome (“Do you win/lose?”), and control-recognition (“Do you have a cow?”) questions. The control-recognition questions tested for a yes bias. When shown birds, children would succeed by responding truthfully, whereas, when shown fish, children needed to utter false statements. Hence, in response to the recall question (“What do you have?”), children should always respond “a bird.” In response to the recognition questions, children should respond “yes” to “Do you have a bird?” and “no” to “Do you have a fish?” In response to the outcome questions, children should respond “yes” to “Do you win?” and “no” to “Do you lose?” The experimenter rewarded bird responses and punished fish responses. When the child succeeded, the experimenter praised the child and put a coin in the box. (“Good, so you win and get a prize.”) When the child failed, the experimenter expressed disappointment and removed a coin. (“Uh oh! You lose and I take away a prize.”)

Overall, children were asked 18 questions about three trials of fish pictures and six questions about one trial of bird pictures, totaling 24 questions across the four trials (four recall, four recognition bird, four recognition fish, four outcome win, four outcome lose, and four control recognition). The order in which children were asked recall, recognition, outcome, and control-recognition questions was counterbalanced across the three blocks of fish pictures, alternating the order in which the questions occurred. In the block of bird pictures, children were asked the questions in the following order: recall, outcome, recognition, and control recognition. If a child did not respond to the experimenter’s question, the experimenter told the child, “Tell me what you think.” If the child remained unresponsive, the question was repeated. If a child continued to remain unresponsive, the experimenter moved to the next trial.

Children’s answers were coded to generate proportion scores, with higher proportions on fish trials reflecting false statements and on bird trials reflecting true statements. When children claimed they had a bird in response to the recall or recognition questions, or claimed that they won in response to the outcome questions, they received one point; otherwise, they received zero points. Children did not receive a point for saying “bird” in response to the outcome questions because this reflected incomprehension. Children were given .5 for persistent “don’t know” and incomprehensible responses so that failures to answer reflected chance responding (2% of all responses). This ensured that zeros reflected truthful responses to bird trials. Latencies were measured as the time elapsed from when the experimenter ceased speaking to when the child first reacted with a response (the beginning of an utterance or the initiation of a head nod/head shake).

Day–night Stroop task. This task consisted of six practice pictures (three of a moon and three of a sun) and 16 test pictures (eight of a moon and eight of a sun; Gerstadt et al. 1994). During the practice phase, children were trained to say “day” when shown a picture of a moon and to say “night” when shown a picture of a sun. Following successful completion of the practice trials, children were then shown a series of 16 test pictures in a randomized order. For each correct response to a picture, children received one point, for a maximum score of 16.

Truth–lie identification task. During this task, children were shown a series of pictures in which a child looked at an object and either truthfully or falsely named the object. Children were shown a total of eight pictures (four truthful and four false). Following each picture, children were asked whether the protagonist told the truth or a lie (Lyon et al., 2012; Task B). Children received one point for each correct identification of truth or a lie, for a total of four for truth and four for lie.

Results

Response Latencies

Logarithmic transformation was performed on children’s latencies to minimize the influence of outliers and reduce skewness (Tabachnick & Fidell, 2007). Raw medians are reported for descriptives for ease of interpretation. Preliminary results revealed no significant effects of gender. Thus, the results for both genders were collapsed for analyses.

First, we examined whether children took longer to respond to questions when they were presented with pictures of fish, which would require false responding for the child to succeed at the game (Hypothesis 1). Table 1 shows the median latency speeds by question and trial type. We conducted a 2 (trial type: fish, bird) × 2 (question type: recall, recognition, outcome) repeated-measures analysis of variance (ANOVA) with latency entered as the dependent variable. Age group was entered as a between-subjects factor. Trial type emerged as a main effect, $F(1, 146) = 63.01$ $p < .001$, $\eta p^2 = .03$. Children's latencies to fish trials were greater (*Mdn* = 1.07, *SD* = 0.72) than latencies to bird trials (*Mdn* = 0.83, *SD* = 0.73), supporting Hypothesis 1. Question type also emerged as a main effect $F(2, 292) = 16.08$, $p < 0.001$, $\eta p^2 = 0.10$. Children's latencies to recall questions (*Mdn* = 1.14, *SD* = 0.99) were longer than their latencies to recognition (*Mdn* = 0.73, *SD* = 0.62) or outcome questions (*Mdn* = 0.91, *SD* = 0.85).

The trial-type by question-type interaction was significant, $F(2, 292) = 14.05$, $p = 0.001$, $\eta p^2 = 0.09$. Figure 1 displays the interaction: The difference between fish trials and bird trials was most pronounced for the

Table 1. Median latencies (in seconds) by question type and trial type

Question type	Fish trials	Bird trials	All trials
Outcome	.93	.83	.91
Recognition	.80	.63	.73
Recall	1.38	.67	1.14

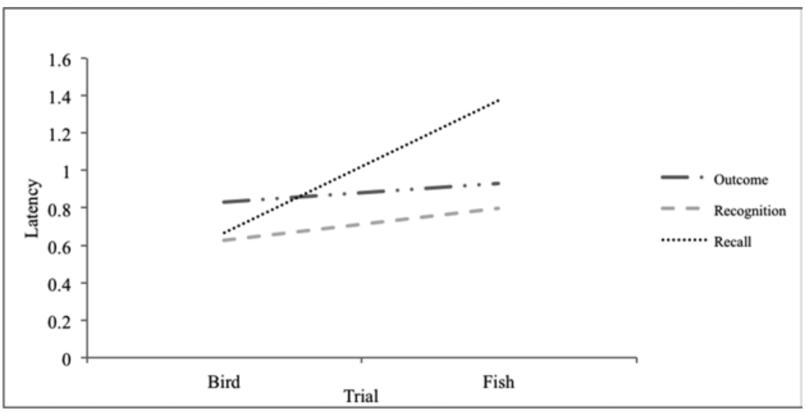

Figure 1. The median latencies (seconds) of children's responses for each question type for the fish trials and the bird trials.

recall questions (Hypothesis 2). We followed up the interaction with repeated-measures ANOVAs for each question type: recall questions $F(1, 148) = 45.72$, $p < .001$, $\eta p^2 = 0.24$; recognition questions $F(1, 149) = 23.09$, $p < .001$, $\eta p^2 = 0.14$; and outcome questions $F(1, 149) = 8.59$, $p = .004$, $\eta p^2 = .06$. Children's latencies were uniformly longer for fish trials than for bird trials, with the recall questions exhibiting the largest difference.

Second, we examined whether children took longer to make false statements than true statements (Hypothesis 3). We conducted a linear regression entering false statement success as the dependent variable, with age group, question type, latency, and interactions of age by question type, latency by question type, and age by latency in the model. When examining the individual contributions of the variables in the model, question type, age by question type, and latency by question type significantly contributed above and beyond all other variables in the model, $\beta = -0.65$, $t(464) = -5.28$, $p =.001$; $\beta = 0.64$, $t(464) = 3.99$, $p = .001$; and $\beta = 0.36$, $t(464) = 3.06$, $p = .002$, respectively. The age by question-type interaction reflected that the recall questions were particularly difficult, even for the oldest children, as previously reported (Ahern et al., 2011).

We followed up the latency by question-type interaction by testing each question type separately. For recall questions, age and latency were entered as predictor variables, and children's false statement success rates were entered as the dependent variable. The model was significant, $R^2 = .25$, $F(2, 154) = 26.1$, $p = .001$. When examining the individual contributions of the variables in the model, age and latency were significant: as age, $\beta = 0.49$, $t(154) = 6.69$, $p = .001$, and latency, $\beta = 0.17$, $t(154) = 2.36$, $p = .02$, increased, children's false statement success increased. When we controlled for age, we found a significant correlation for latency and false statement success ($r = .19$, $p = .02$).

A similar linear regression was conducted for recognition questions. The model was significant, $R^2 = 0.18$, $F(2, 154) = 17.46$, $p = .001$. When examining the individual contributions of the variables in the model, age significantly contributed above and beyond all other variables, indicating that as age increased children were more likely to succeed at false statements, $\beta = 0.41$, $t(154) = 5.68$, $p = .001$. Latency was not significant $\beta = 0.12$, $t(154) = 1.69$, $p = .09$. Similarly, when controlling for age, latency and false statement success were not significantly correlated ($r = .14$, $p = .09$). Hence, for recall questions but not for recognition questions, Hypothesis 3 was supported: false statements exhibited longer latencies than did true statements.

Because we predicted that the youngest children might succeed on the outcome questions with impulsive desire-based responses, so that they would not take longer to make false statements (Hypothesis 4), we tested for an interaction between age and latency for the outcome questions. We entered age group, latency, and an age-by-latency interaction term. The model significantly increased the proportion of variance explained, $F(3, 154) = 6.13$, $p = .001$, $R^2 = 0.11$. When examining the individual contributions of the variables in the model, we found that age contributed above and beyond all other variables in the model, $\beta = .26$, $t(154) = 3.32$, $p = .001$. Latency alone was not significant, $\beta = 0.26$, $t(154) = 1.21$, $p = .23$. However, the age-by-latency interaction was significant, $\beta = -0.47$, $t(154) = -2.17$, $p = .03$.

Given the significant interaction between age and latency for outcome questions, we conducted Pearson correlations for each age group for false statement success and latency. Latency was significant for only the oldest age group, consistent with Hypothesis 4. The longer the oldest children took to respond to outcome questions, the more likely they were to be proficient ($r = -.36$, $p = .02$). Latency was not significant for the youngest age group ($r = .04$, $p = .82$) or the middle age group ($r = -.17$, $p = .16$).

The False Statement Task, Day–Night Stroop Task, and Truth–Lie Identification Task

Table 2 shows the means, standard deviations, and maximum and minimum scores for both the day–night Stroop task and the truth–lie identification task. While controlling for age group, partial correlations were conducted for each task (Table 3). Day–night Stroop task performance was not significantly correlated with false statement task performance, inconsistent with Hypothesis 5. In contrast, truth–lie identification task performance was positively correlated with false statement task performance ($r = .24$, $p = .007$), consistent with Hypothesis 6, specifically with respect to the recognition questions in the false statement task ($r = .19$, $p = .03$).

Table 2. Means (standard deviations) for day–night Stroop task and truth–lie recognition task by age categories

Task	2 years, 7 months, to 3 years, 6 months	3 years, 7 months, to 4 years, 6 months	4 years, 7 months, to 5 years, 7 months	Total mean (*SD*)
Day–night Stroop task (max. score = 16)	9.19 (4.80)	12.08 (4.22)	14.18 (3.57)	12.19 (4.49)
Truth–lie recognition task (max. score = 8)	4.05 (.90)	5.17 (1.78)	6.77 (1.68)	5.34 (1.86)

Table 3. Correlations between bird–fish success, truth–lie recognition, and day–night Stroop, controlling for age by groups

Variable	1	2	3	4	5
1. Bird–fish success	–				
2. Day–night Stroop	−.07	–			
3. Truth recognition	.27**	.18*	–		
4. Lie recognition	.13	−.11	.34**	–	
5. Truth–lie total	.24**	.03	.80**	.84**	

*p .05. **p .01.

Discussion

This study examined the relations among young children's production of false statements, response latency, executive functioning, and truth–lie understanding. Children were taught a game in which they received prizes for labeling pictures as birds, regardless of whether they were birds or fish. They were asked recall ("What do you have?"), recognition ("Do you have a bird/fish?"), and outcome ("Do you win/lose?") questions. We measured response latencies and assessed children's executive functioning (through the day–night Stroop task) and ability to identify truth and lies. In what follows, we discuss the extent to which our hypotheses were supported and speculate about unexpected findings. We then describe the limitations of our research and promising future directions.

Cognitive Effort and False Statements

We predicted that children would take longer to respond to the fish pictures than the bird pictures because of the cognitive effort required to succeed—children had to make a false statement about a currently perceived object. This hypothesis was confirmed. We predicted that the difference between response latencies for fish and bird pictures would be most pronounced for recall questions because recall requires one to generate a response rather than to simply accept or reject a proffered response (as in the yes/no questions asked by the recognition and outcome questions). This hypothesis was also confirmed. Although children took longer to respond to fish pictures than to bird pictures for all three types of questions, the difference was largest for recall questions. Indeed, an incidental finding was that recall questions in general elicited the longest response latencies.

Consistent with a large body of literature finding longer response latencies for lies than for truthful statements (e.g., Suchotzki et al., 2017), we predicted that, in general, response latencies would be longer for false statements than for truthful statements, and this hypothesis was partially supported. There was not a main effect for latency, but latency interacted with question type. False recall answers took longer than true recall answers, but false recognition answers took no long than true recognition answers. This echoes the aforementioned finding, since it suggests that the effort required for generating false recall responses led to response latency differences between true and false recall responses, whereas the relative ease with which one can generate false recognition responses (just say "yes" to bird and "no" to fish) meant there were no response latency differences between true and false recognition responses.

Perhaps our most provocative hypothesis was that the response latencies for outcome questions would exhibit a different pattern such that the latency differences between true and false responses would interact with age. This hypothesis was also confirmed: False outcome responses took longer than true outcome responses, but only for the oldest children. In other words, for the younger children, false outcome responses came to them as quickly as true outcome responses.

Why would this be so? The concept of pseudo-lies, as originally propounded by the Sterns (1909) and elaborated on by Ahern and colleagues (2011), suggests that some of young children's false statements are impulsive utterances generated by their focus on what they want rather than what they believe. Outcome questions ("Do you win/lose?") can elicit desire-based responses because, without reflecting on the picture before them (whether fish or bird) or the rules of the game ("If you say you have a bird you win and if you say you have a fish you lose"), the young child knows it is good to win and bad to lose. Of course, older children are equally aware that it is good to win and bad to lose. But they may be more likely to think beyond the superficial desirability of winning and losing and think through their answer to the question—when they have a bird, they can honestly say they do and they win, but, when they have a fish, they must dishonestly claim to win. Their greater awareness of the falsity of their answer gives them pause, unlike the younger children, who can blithely claim to win in the face of whatever picture they encounter.

Executive Functioning and False Statements

Prior research has found that children's tendency to lie is positively related to executive functioning as measured by the day–night Stroop task (Evans & Lee, 2013; Talwar & Lee, 2008). We were surprised to find children's false statement success was not related. We believe that the different results may be due to the differences between the false statement task and both the day–night Stroop task and children's deceptive behaviors in prior research.

In our task, we minimized the difficulties in making false statements. First, in addition to training children to "always say you have a bird," we reinforced children for making false statements (and punished them for failing to do so) throughout the task. By doing so, we minimized both cognitive and motivational difficulties. Consistent reinforcement both reminded them of the rules of the game and helped to overcome any reluctance they might have to make false statements. In contrast, although children are provided training on the day–night Stroop task, they are not reminded of the rules of the game as the task proceeds, and children's performance tends to deteriorate during the task (Diamond, Kirkham, & Amso, 2002). Indeed, research has found that children's success on inhibitory tasks can be improved through rewards (Simpson, Riggs, & Simon, 2004) and verbal feedback (Müller, Zelazo, Hood, Leone, & Rohrer, 2004). Similarly, when children provided deceptive responses in the studies examining the correlates of lying, they did so without any reminders or external inducement. Children were obviously motivated to lie because they had committed a transgression, but cutting against this motivation was any compunction they may have felt against lying.

Second, we gave children a single rule: Always say that you have a bird. The day–night Stroop task requires children to work with two rules: if sun, then say night; and, if moon, then say day. (One can reduce the task to a single rule, but only by creating a higher-order rule: say the opposite; Montgomery & Koeltzow, 2010.) Third, in contrast to the lies studied by other researchers, our false statement task may have eased the working memory demands of the task by reducing any possible compunction against lying. We suspect that our false statement task is more analogous to simpler executive functioning tasks, which might better predict children's performance. For example, in the whisper task, the child is taught to answer every question by whispering, which requires just one rule ("always whisper") (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996).

There seems to be a developmental progression in the extent to which different types of executive functioning tasks predict lying, which maps onto the extent to which working memory is taxed. Tasks that simply measure inhibition, such as the gift-delay task, fail to predict lying even in very young children (Evans & Lee, 2013). In contrast, there is some evidence that the whisper task—measuring inhibition coupled with a single rule for generating the subdominant response—correlates with lying in very young children (finding a marginally significant relation among 2- to 3-year-olds;

Williams et al., 2017; see also Leduc et al., 2017). In turn, Talwar and Lee (2008), testing 3- to 8-year-olds, did not find that children's performance on the whisper task predicted lying, but did find that the day–night Stroop task was predictive. Among still older children (8- to 16-year-olds), Evans and Lee (2011) did not find a relation between their Stroop task (word color) and lying, but did find that the task predicted children's tendency to maintain the lie over the course of questioning.

Future research could examine children's false statement abilities (including lying) in relation to a battery of executive functioning measures and could assess the working memory demands of different types of false statements; sometimes the child can succeed by keeping just one rule in mind. Moreover, an interesting topic for future research is whether and how children's moral objections to lying affect the relation between lies and executive functioning.

Truth–Lie Identification and False Statements

Consistent with our prediction, children who performed better on the truth–lie identification task were more proficient at making false statements, consistent with prior research that has found either no relation or a positive relation between truth–lie understanding and lying (Talwar & Lee, 2002, 2008; Talwar et al., 2004; Williams et al., 2017). Children are often asked to demonstrate their truth–lie understanding in forensic settings, with the assumption that understanding increases the likelihood that the child will be truthful (Lyon, 2011). Our finding suggests that this assumption is unwarranted and in fact backwards; as children become more proficient at recognizing true and false statements as such, they are better able to make false statements. The practical utility of asking children about understanding of truth is not in ensuring truthfulness, but in determining whether the child understands elicitations of promises to tell the truth.

Conclusion

In closing, we found support for the proposition that young children's difficulty in making false statements depends upon the type of questions asked. Recall questions, which require the child to generate information, require more cognitive effort, as reflected by response latencies, in contrast to recognition questions, which merely require the child to affirm or deny information. The response latency data suggested that outcome questions that refer to a clearly desirable or undesirable outcome (winning or losing) could be answered falsely through impulsive desire-based responses such that the younger children did not exhibit latency differences between true and false statements. Our results with respect to executive functioning suggest that researchers should attend to the different working memory demands of different situations in which children make false statements. Finally, the relation between children's truth–lie understanding and their ability to make false statements challenges legal assumptions about the indicia of children's honesty.

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