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Within-Pair Consistency in Child Witnesses:
The Diagnostic Value of Telling the Same Story

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Abstract

Judges and jurors often rely on consistency for assessing veracity. The present study examined the diagnostic value of within-pair consistency to predict truth-telling in pairs of children aged 8 to 10. Twenty-three pairs were questioned about one experienced event and one imagined event (which they had discussed before questioning). Within-pair consistency was significantly higher for experienced events than for imagined events. The diagnostic value of within-pair consistency to predict truth-telling was, however, modest: approximately one out of three judgments based on this cue would have been mistaken. Analyses of children's discussions of the imagined events revealed that interview questions about topics that had been discussed before questioning did not effectively discriminate experienced and imagined events, providing support for theoretical assumptions underlying the unanticipated-question approach. Practical recommendations for police interviewers are provided.

Keywords: child witnesses, within-pair consistency, diagnostic value, deception detection, unanticipated questions

Within-Pair Consistency in Child Witnesses: The Diagnostic Value of Telling the Same Story

Consider the following hypothetical case: two brothers, eight and ten, accuse their father of sexual abuse. There is no evidence other than the boys' allegations, which are remarkably similar. In a case like this, an expert witness might be asked to comment on whether the observed consistency between the children's statements indicates that they experienced the event.¹ Even though witness consistency is typically viewed as a sign of truth-telling (e.g., Strömwall & Granhag, 2003), only a few studies, conducted with adults and adolescents, examined this belief empirically (Granhag, Strömwall, & Jonsson, 2003; Roos af Hjelmsäter, Öhman, Granhag, & Vrij, 2012; Strömwall & Granhag, 2007; Vrij et al., 2009). The present study investigates the extent to which within-pair consistency in children's testimonies discriminates experienced from imagined events, and explores why certain interview questions discriminate experienced and imagined events more effectively than others.

Deception Detection

Generally, humans are not very good at detecting lies, performing only a little above chance (Bond & DePaulo, 2006; Vrij, Akehurst, Brown, & Mann, 2006). One reason for this relatively poor performance could be that observers rely on the wrong cues (Strömwall & Granhag, 2003; Vrij, 2008). For instance, people generally believe that gaze aversion predicts deception (Global Deception Research Team, 2006), even though there is no empirical support for this belief (DePaulo et al., 2003). In a recent meta-analysis, however, Hartwig and Bond (2011) found that observers typically do rely on

¹ Although fictional, this case bears significant similarities to a real case that appeared before the Dutch court, in which the judge asked the second author to provide expert testimony about exactly this question.

valid cues to deception, even though they are not aware they are using these cues.

Hartwig and Bond argue that deception detection is generally poor not because observers attend to the wrong cues, but rather because there are too few observable differences between liars and truth-tellers.

One potential solution to the relative scarcity of cues to deception is to use interview methods that elicit and amplify these cues, making it easier for observers to detect lies (Hartwig & Bond, 2011; Vrij, Granhag, Mann, & Leal, 2011). For instance, observers are significantly better at detecting deceit when suspects experience high cognitive load during the interrogation (Vrij, Leal, Mann, & Fisher, 2012; Vrij et al., 2008), or when incriminating evidence is used strategically (Granhag & Hartwig, 2008; Hartwig, Granhag, & Strömwall, 2007; Hartwig, Granhag, Strömwall, & Kronkvist, 2006). Similarly, certain types of questions (notably, unanticipated questions) amplify and elicit cues to deception in adults' and children's testimony (Leins, Fisher, & Vrij, 2012; Leins, Fisher, Vrij, Leal, & Mann, 2011; Liu et al., 2010).

Within-Pair Consistency

Generally, lay people and legal professionals believe that consistency indicates truth-telling (Granhag & Strömwall, 2000; Greuel, 1992; Strömwall & Granhag, 2003).

Consistency can be examined within an interview, between interviews with one suspect, or among several suspects. The present paper focuses on within-pair consistency (see Vredeveldt, Van Koppen, & Granhag, in press, for a review of different types of consistency). Wagenaar and Dalderop (1994) were the first to compare within-pair consistency in lying and truth-telling pairs of adults. They sent six pairs to the zoo, and instructed six other pairs to fabricate a mutually coherent story about going to the zoo.

Subsequently, all participants were interrogated individually about the zoo visit. In contrast to the popular belief that consistency is a sign of truth-telling, lying pairs were significantly more consistent than truth-telling pairs. In a similar vein, Granhag and colleagues (2003) interrogated pairs of undergraduates on two occasions about a lunch meeting, and found that the testimony of lying pairs contained *more* overlapping themes and was rated as *more* consistent than the testimony of truth-telling pairs.

Granhag and Strömwall (1999) note that lying suspects remember and carefully repeat the story agreed upon before the interrogation, thus promoting within-pair consistency. In contrast, truth-telling suspects provide statements by remembering the event. The reconstructive nature of memory, combined with a tendency to be less concerned with appearing consistent, undermines within-pair consistency for truth-telling suspects. Preparation is an important characteristic of this “repeat versus reconstruct hypothesis”: lying suspects can achieve consistency only if they coordinate their responses to potential interview questions before interrogation. For instance, Vrij et al. (2009) found no difference in within-pair consistency between liars and truth-tellers’ responses to anticipated questions about a lunch meeting (e.g., “What did you do in the restaurant?”), but significantly lower within-pair consistency for liars than truth-tellers’ in response to unanticipated questions (e.g., “Who finished his food first?”). The authors explained this in terms of preparation: liars discussed and planned their answers to anticipated questions, but did not do so for unanticipated questions.

Two studies investigated within-pair and within-triad consistency in 12-14 year old adolescents. Strömwall and Granhag (2007) interviewed pairs of adolescents about an experienced or imagined encounter with an unknown man. Pairs who had experienced the event were significantly more consistent than pairs who had imagined

it. Roos af Hjelmsäter, Öhman, Granhag, and Vrij (2012) interviewed groups of three adolescents about the same event. In addition to Strömwall and Granhag's standard questions (e.g., describe the event and the actors in it), Roos af Hjelmsäter and colleagues presented the adolescents with an unanticipated task, namely, marking the positions of the actors on a spatial lay-out. They found that adult observers rated the triads of adolescents who had experienced the event as significantly more consistent than the triads who had imagined it. However, the difference between conditions was only observed for the unanticipated spatial task, and was only significant for the salient spatial aspects of the event.

In sum, when lying pairs have the opportunity to rehearse their story, within-pair consistency does not seem predict truth-telling for adult suspects (Granhag, et al., 2003), although it may be a sign of truth-telling for adolescents (Strömwall & Granhag, 2007). This difference may be due to developmental differences in social and cognitive functioning. For instance, most adults understand that appearing consistent to others is vital to being believed, a level of understanding that may be less well-developed in children and young adolescents (Gallup, 1998; Johnson et al., 2005). Furthermore, even if children are aware of the importance of appearing consistent, they may be less adept at controlling the verbal content of their statements than adults are (cf. Talwar & Lee, 2002).

The Present Study

The present study examined within-pair consistency in 8-10 year-old children, comparing testimony about experienced events ("truth-tellers") and imagined events

(“liars”).² Based on previous adolescent findings (Roos af Hjelmsäter, et al., 2012; Strömwall & Granhag, 2007), we predicted that truth-telling pairs would be significantly more consistent than lying pairs. Moving beyond significance testing, we assessed the diagnostic value (DV) of consistency cues (cf. Wagenaar, Van Koppen, & Crombag, 1993). A DV is determined by dividing the number of hits (e.g., within-pair consistency for truth-tellers) by the number of false alarms (e.g., within-pair consistency for liars). For example, if 80% of truthful pairs and 10% of lying pairs are consistent, the statement “within-pair consistency—therefore truthful” has a DV of 8 (80% / 10%). In contrast, the statement “no within-pair consistency—therefore lying”, has a DV of 4.5 (90% / 20%). Hence, DV estimates the strength of a piece of evidence. For example, a finding that eight out of nine pairs of children who tell a consistent story also tell the truth is more informative than stating that truth-telling pairs are “significantly” more consistent than lying pairs.

The present research also directly tests the claim that anticipated questions less effectively distinguish between liars and truth-tellers because lying pairs have discussed these before questioning (see e.g., Vrij & Granhag, 2012; Vrij, et al., 2009; 2011). Previous studies on unanticipated questions have not presented measures of the pre-questioning discussions of lying pairs. In contrast, we analysed the content of children’s discussions of the imagined event. Based on Vrij and colleagues’ theoretical assertions, we predicted that interview questions that had been discussed before questioning would

² The use of the terms “liars” in the present context is controversial, because children in the present study had no motivation to lie, and were not explicitly instructed to lie. We nevertheless used these terms to keep the terminology consistent with previous articles on this topic (e.g., Roos af Hjelmsäter, et al., 2012; Strömwall & Granhag, 2007; Strömwall, Granhag, & Jonsson, 2003). Thus, “truth-telling” in the current context should be interpreted as “providing testimony about experienced events”, whereas “lying” should be interpreted as “providing testimony about imagined events”.

discriminate experienced and imagined events less effectively than interview questions that had not been discussed.

Method

Participants

Forty-six children (23 girls and 23 boys) from a primary school in The Netherlands participated. Twenty-six were in third grade (ages 8 to 9) and twenty were in fourth grade (ages 9 to 10). The school principal and the children's parents gave informed assent before the study began.

Materials

Children were questioned about two school events that occurred a few weeks before the study. The first, experienced by the third graders, was a "Reinaert de Vos" (a Dutch folktale about a fox) themed arts-and-crafts day. The second, experienced by the fourth graders, was an athletics day, during which the children participated in various sporting activities. Six questions were posed about each of these events (see Table 2).

Procedure

The data from randomly paired same-grade children were collected in a quiet corridor in the primary school separated from the rest of the class. Each pair was seated at a table and asked to imagine being at the event they had not experienced (i.e., the athletics day for third-graders, and the arts-and-crafts day for fourth-graders) and talk about what happened during that event. To facilitate the discussion, the children who imagined athletics day received the following instructions: "Some time ago, children in the fourth

grade had an athletics day, which was part of a competition between various schools. I would like you two to discuss together what it would be like to be at the athletics day, what you would do, what kind of exercises there would be, whether you would like it or not, who would join you, how long it would take, and so on.” The children who imagined the arts-and-crafts day received the following instructions: “Some time ago, children from the third grade had an arts-and-crafts day with the theme “Reinaert de Vos”, which is a folktale about a fox. On that day, a mother of one of the children told the story of “Reinaert de Vos” and afterwards, all children did arts and crafts with that theme. I would like you two to discuss together what it would be like to have a “Reinaert de Vos” day, what you would make, whether you would like it or not, whose mother would come, how long it would take, and so on.” The children discussed the imagined event as long as they wanted, taking less than two minutes on average ($M = 117s, SD = 32s$). All discussions were audiotaped.

Once finished, each child completed a questionnaire sheet individually. One side of the paper presented questions about the imagined event; the other side presented questions about the experienced event (Table 2 lists all interview questions). The topic order was counterbalanced; half of the children answered questions about the experienced event first, the other half about the imagined event first. Children were instructed to answer all questions. They were not instructed to tell the same story as their partner, but were instructed to answer the questions about the imagined event as if they had been there.

Data Coding

Two independent coders, blind to the type of event (experienced or imagined), coded the questionnaire responses as consistent, partially consistent, or contradictory. When pairs provided exactly the same answer (e.g., “A story about a fox”), their answers were coded as consistent. When the answers overlapped partially, but one child included elements that the other child did not mention (e.g., “A story about a fox” compared to “A story about a fox who stole cheese”), they were coded as partially consistent. When the answers contradicted each other (e.g., “A story about a fox” compared to “A story about an elephant”), they were coded as contradictory. Inter-rater reliability (based on 276 data points) was $\kappa = .88, p < .001$. Coding disagreements were resolved by discussion. For each event, an overall within-pair consistency score was calculated by awarding one point for consistent answers, half a point for partially consistent answers, and zero points for contradictory answers (consistency scores ranged from 0 to 6).

Results

The data for one pair concerning the experienced event was deleted because one fourth-grader did not attend athletics day.

Within-Pair Consistency

Consistent with our predictions, an independent t-test revealed significantly higher within-pair consistency scores for experienced ($M = 3.89, SD = .98$) than imagined events ($M = 1.91, SD = 1.04$), $t(21) = 6.58, p < .001$. Table 1 shows within-pair consistency frequencies and percentages. Considering consistent answers in isolation produced a DV for the statement “within-pair consistency—therefore truthful” of 57% /

28% = 2.04. Considering consistent and partially-consistent answers together produced a DV of $73\% / 36\% = 2.03$ for the statement. Conversely, the DV of the statement “within-pair contradiction—therefore lying” was $64\% / 27\% = 2.37$. In short, truth-telling pairs provided two out of three consistent responses, and lying pairs produced two out of three contradictory responses.

[TABLE 1 NEAR HERE]

Discussion of Imagined Events

The duration of discussions about the arts-and-crafts event ($M = 124s$, $SD = 27s$) and the athletics event ($M = 111s$, $SD = 36s$; $t < 1$) did not differ significantly. The number of topics appearing on the questionnaire, however, were greater for those discussing the arts-and-craft event ($M = 2.00$, $SD = .47$) than those discussing the athletics event ($M = .54$, $SD = .52$), $t(20.34) = 7.05$, $p < .001$ (see Table 2). It is unclear if the difference in the number of topics covered was due to age or the nature of the event, because the third-graders discussed the athletics event and the fourth-graders discussed the arts-and-crafts event.

[TABLE 2 NEAR HERE]

Interview Questions

Within-pair consistency in response to two questionnaire items discriminated lying and truth-telling pairs of children at a highly conservative Bonferroni-corrected level of significance ($p < .004$). These concerned the type of animal (besides the fox) made

during the arts-and-crafts day, and the type of material that was unavailable that day (see Table 2). Whether a specific topic had been discussed prior to questioning significantly predicted subsequent within-pair consistency for that question, $\chi^2(2) = 10.43$, $p < .01$. For discussed topics, 48.1% of responses provided by the lying pairs were consistent (and 14.8% partially consistent). For topics that were not discussed, 23.4% of responses were consistent (and 6.3% partially consistent).

Discussion

Within-pair consistency for 8-10 year old children was significantly higher for experienced than imagined events, in line with previous findings for 12-14 year old adolescents (Roos af Hjelmsäter, et al., 2012; Strömwall & Granhag, 2007). However, the diagnostic value of within-pair consistency to predict truth-telling was modest: only two out of three consistent responses were provided by a pair of children that had experienced the event ($DV = 2.04$). Inconsistency was not particularly diagnostic of lying either ($DV = 2.37$). Finally, discussion of an interview question before questioning was a significant predictor of subsequent within-pair consistency, confirming theoretical assertions associated with the unanticipated-question approach (e.g., Vrij, et al., 2009).

Within-Pair Consistency

Previous research with adults did not provide support for the popular belief that within-pair consistency predicts truth-telling (Granhag, et al., 2003; Wagenaar & Dalderop, 1994). For 12-14 year old adolescents, however, there are some data indicating that truth-telling pairs and triads are significantly more consistent than lying pairs or triads (Roos af Hjelmsäter, et al., 2012; Strömwall & Granhag, 2007). The present findings

suggest that truth-telling pairs of 8-10 year-old children are also significantly more consistent than lying pairs. The observed difference between adults, on the one hand, and adolescents and children, on the other, is likely due to adults' greater level of awareness of the fact that observers use consistency cues to determine if someone is lying (cf. Gallup, 1998; Johnson, et al., 2005). Furthermore, children may not yet have optimal control over the verbal content of their statements (cf. Talwar & Lee, 2002). Although within-pair consistency may serve as a better cue to deception for children than adults, this is not necessarily sufficient to improve observers' overall deception-detection abilities. For instance, Vrij et al. (2006) found no difference in adult observers' abilities to detect lies in children, adolescents, or adults.

In a court setting, prosecuting attorneys could use the present findings to argue that consistency between two child witnesses indicates that an alleged criminal event really happened. Our analysis of diagnostic values, however, suggests that the practical value of within-pair consistency is modest. Diagnostic values can be used to formulate recommendations about the extent to which jurors or judges should change their mind about the guilt of a suspect when presented with a certain type of evidence (cf. Juslin, Olsson, & Winman, 1996; Wagenaar, et al., 1993). In the present experiment, one out of three responses perceived to be consistent within a pair of children was about an imagined event. Thus, although both lay people and legal professionals may believe that consistency reliably predicts truth-telling (e.g., Strömwall & Granhag, 2003), the present evidence suggests that one out of three decisions based on this cue is mistaken.

Interview Questions

Previous research on within-pair consistency for adults (Vrij, et al., 2009) and within-triad consistency for adolescents (Roos af Hjelmsäter, et al., 2012) demonstrates that unanticipated questions discriminate liars and truth-tellers better than anticipated questions. This finding has been explained by the claim that groups of liars discuss and plan answers to the anticipated questions before questioning, which promotes consistency. Previous studies, however, did not include a direct test of this assumption. The present analysis, which included a direct test of this assertion, confirmed that none of the effective questions in the present study had been discussed by more than 10% of the pairs before questioning.

There were, however, a few questions that had not been discussed by lying pairs before questioning, that were nevertheless ineffective in discriminating between liars and truth-tellers. Some of these questions were ineffective because both truth-telling and lying pairs achieved relatively *high* consistency (e.g., concerning the elements involved in the relay race). It is possible that children anticipated, but did not discuss these questions. This view, however, leaves the question of how lying pairs achieved within-pair consistency for these topics without discussing them before questioning. Perhaps, these questions addressed aspects of the event likely to be in children's event scripts (Schank & Abelson, 1977). Children typically develop and use scripts when recalling everyday events (see Nelson, 1986). Thus, lying pairs of children may have been able to provide relatively consistent responses to certain interview questions by relying on shared event scripts of what happens during these kinds of events.

Other interview questions were ineffective in discriminating liars and truth-tellers because both truth-telling and lying pairs showed relatively *low* consistency (e.g.,

concerning the exact number of exercises performed during the athletics event). The low level of consistency for truth-telling pairs may have occurred because the children did not pay attention to peripheral details of the experienced event.³ In support of this explanation, Roos af Hjelmsäter and colleagues (2012) found that truth-telling pairs of adolescents were more consistent in their answers about salient details of the event than about non-salient details that probably did not attract the adolescents' attention during the event.

In sum, there are at least three reasons why interview questions can be ineffective in discriminating lying and truth-telling pairs of children: (1) lying pairs can achieve consistency by discussing questions before questioning, (2) lying pairs can achieve consistency by relying on shared event scripts, and (3) truth-telling pairs may be inconsistent with respect to non-salient aspects of the event.

Limitations and Future Directions

An important limitation to the present research was that the “lying” pairs of children were not coached to provide consistent testimony about the imagined event and had no clear motivation to lie. In real life, children are often coached before providing testimony, for example by a parent (cf. Lyon, Malloy, Quas, & Talwar, 2008; Talwar, Lee, Bala, & Lindsay, 2006; Talwar, Lee, Bala, & Lindsay, 2004). Moreover, it is difficult for adult observers to differentiate between real and fabricated testimony when children have been coached (Talwar et al., 2006). The absence of coaching and motivation to lie in this and previous research (e.g., Roos af Hjelmsäter, et al., 2012; Strömwall & Granhag, 2007) may indicate that the present findings *overestimate* the

³ We thank Pär Anders Granhag for this suggestion.

diagnostic value of within-pair consistency for children in legal settings. In addition, future research could improve the ecological validity of the research by examining testimony for negative emotional events, and by using a combination of free- and cued-recall formats.

Practical Recommendations

The present research, taken with the body of research in this area, permits only tentative recommendations to police interviewers. First, discussion between child witnesses should be prevented whenever possible. Co-witness discussion of an experienced event can lead to memory contamination in adult witness testimony (Gabbert, Memon, & Allan, 2003; Gabbert, Memon, & Wright, 2006; Shaw, Garven, & Wood, 1997), and the present study shows that co-witness discussion of an imagined event promotes within-pair consistency in children, reducing the diagnostic value of within-pair consistency to discriminate between experienced and imagined events. Because discussions between witnesses—including children—cannot always be prevented, we recommend that investigative interviewers ask questions about topics unlikely to have been anticipated, unlikely to be part of children’s shared event scripts (see also Brubacher, Roberts, & Powell, 2011), and unlikely to have been missed by children who experienced the event.

Conclusion

Let us return to the hypothetical case in which two boys accused their father of sexual abuse, and provided remarkably similar testimonies. Based on previous and present findings, an expert witness asked to testify in this case could tell adjudicators that truth-telling pairs of children and adolescents are significantly more likely to provide

consistent testimony than lying pairs (provided that they were not coached). It would, however, be more informative to indicate how well within-pair consistency evidence predicts truth-telling. The present findings suggest that the diagnostic value of within-pair consistency in children is modest at best; that is, one out of three truth judgments based on this evidence is mistaken. Thus, although a high level of within-pair consistency between children's testimonies is intuitively persuasive, consistency on its own should not be sufficient to eliminate "reasonable doubt".

References

- Bond, C. F., & DePaulo, B. M. (2006). Accuracy of deception judgments. *Personality & Social Psychology Review*, *10*(3), 214–234. doi: 10.1207/s15327957pspr1003_2
- Brubacher, S. P., Roberts, K. P., & Powell, M. B. (2011). Effects of practicing episodic versus scripted recall on children's subsequent narratives of a repeated event. *Psychology, Public Policy, and Law*, *17*(2), 286–314. doi: 10.1037/a0022793
- DePaulo, B. M., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to deception. *Psychological Bulletin*, *129*(1), 74–118. doi: 10.1037/0033-2909.129.1.74
- Gabbert, F., Memon, A., & Allan, K. (2003). Memory conformity: Can eyewitnesses influence each other's memories for an event? *Applied Cognitive Psychology*, *17*(5), 533–543. doi: 10.1002/acp.885
- Gabbert, F., Memon, A., & Wright, D. B. (2006). Memory conformity: Disentangling the steps toward influence during a discussion. *Psychonomic Bulletin & Review*, *13*(3), 480–485. doi: 10.3758/BF03193873
- Gallup, G. G. (1998). Self-awareness and the evolution of social intelligence. *Behavioural Processes*, *42*(2–3), 239–247. doi: 10.1016/s0376-6357(97)00079-x
- Global Deception Research Team. (2006). A world of lies. *Journal of Cross-Cultural Psychology*, *37*(1), 60–74. doi: 10.1177/0022022105282295
- Granhag, P. A., & Hartwig, M. (2008). A new theoretical perspective on deception detection: On the psychology of instrumental mind-reading. *Psychology, Crime & Law*, *14*(3), 189–200.

- Granhag, P. A., & Strömwall, L. A. (1999). Repeated interrogations – Stretching the deception detection paradigm. *Expert Evidence*, 7(3), 163-174. doi: 10.1023/a:1008993326434
- Granhag, P. A., & Strömwall, L. A. (2000). Effects of preconceptions on deception detection and new answers to why lie-catchers often fail. *Psychology, Crime & Law*, 6(3), 197-218. doi: 10.1080/10683160008409804
- Granhag, P. A., Strömwall, L. A., & Jonsson, A.-C. (2003). Partners in crime: How liars in collusion betray themselves. *Journal of Applied Social Psychology*, 33(4), 848-868. doi: 10.1111/j.1559-1816.2003.tb01928.x
- Greuel, L. (1992). Police officers' beliefs about cues associated with deception in rape cases. In F. Lösel, D. Bender & T. Bliesener (Eds.), *Psychology and law - International perspectives* (pp. 234–239). Berlin: Walter de Gruyter.
- Hartwig, M., & Bond, C. F. (2011). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin*, 137(4), 643–659. doi: 10.1037/a0023589
- Hartwig, M., Granhag, P. A., & Strömwall, L. A. (2007). Guilty and innocent suspects' strategies during police interrogations. *Psychology, Crime & Law*, 13(2), 213–227.
- Hartwig, M., Granhag, P. A., Strömwall, L. A., & Kronkvist, O. (2006). Strategic use of evidence during police interviews. *Law and Human Behavior*, 30(5), 603-619. doi: 10.1007/s10979-006-9053-9
- Johnson, A. K., Barnacz, A., Yokkaichi, T., Rubio, J., Racioppi, C., Shackelford, T. K., . . . Keenan, J. P. (2005). Me, myself, and lie: The role of self-awareness in

- deception. *Personality and Individual Differences*, 38(8), 1847-1853. doi: 10.1016/j.paid.2004.11.013
- Juslin, P., Olsson, N., & Winman, A. (1996). Calibration and diagnosticity of confidence in eyewitness identification: Comments on what can be inferred from the low confidence–accuracy correlation. [doi:10.1037/0278-7393.22.5.1304]. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22(5), 1304–1316. doi: 10.1037/0278-7393.22.5.1304
- Leins, D. A., Fisher, R. P., & Vrij, A. (2012). Drawing on liars' lack of cognitive flexibility: Detecting deception through varying report modes. *Applied Cognitive Psychology*, n/a-n/a. doi: 10.1002/acp.2837
- Leins, D. A., Fisher, R. P., Vrij, A., Leal, S., & Mann, S. (2011). Using sketch drawing to induce inconsistency in liars. *Legal and Criminological Psychology*, 16(2), 253-265. doi: 10.1348/135532510x501775
- Liu, M., Granhag, P. A., Landström, S., Roos af Hjelmsäter, E., Strömwall, L. A., & Vrij, A. (2010). “Can you remember what was in your pocket when you were stung by a bee?”: Eliciting cues to deception by asking the unanticipated. *The Open Criminology Journal* 3, 31-36. doi: 10.2174/1874917801003010031
- Lyon, T. D., Malloy, L. C., Quas, J. A., & Talwar, V. A. (2008). Coaching, truth induction, and young maltreated children’s false allegations and false denials. *Child Development*, 79(4), 914–929. doi: 10.1111/j.1467-8624.2008.01167.x
- Nelson, K. (Ed.). (1986). *Event knowledge: Structure and function in development*. Hillsdale, NJ: Erlbaum.
- Roos af Hjelmsäter, E., Öhman, L., Granhag, P. A., & Vrij, A. (2012). ‘Mapping’ deception in adolescents: Eliciting cues to deceit through an unanticipated

- spatial drawing task. *Legal and Criminological Psychology*, n/a-n/a. doi: 10.1111/j.2044-8333.2012.02068.x
- Schank, R. C., & Abelson, R. P. (1977). *Scripts, plans goals and understanding: An enquiry into human knowledge structures*. Hillsdale, NJ: Erlbaum.
- Shaw, J. S., III, Garven, S., & Wood, J. M. (1997). Co-witness information can have immediate effects on eyewitness memory reports. *Law and Human Behavior*, 21(5), 503–523. doi: 10.1023/A:1024875723399
- Strömwall, L. A., & Granhag, P. A. (2003). How to detect deception? Arresting the beliefs of police officers, prosecutors and judges. *Psychology, Crime & Law*, 9(1), 19-36. doi: 10.1080/10683160308138
- Strömwall, L. A., & Granhag, P. A. (2007). Detecting deceit in pairs of children. *Journal of Applied Social Psychology*, 37(6), 1285–1304.
- Strömwall, L. A., Granhag, P. A., & Jonsson, A.-C. (2003). Deception among pairs: “Let’s say we had lunch and hope they will swallow it!”. *Psychology, Crime, and Law*, 9(2), 109–124.
- Talwar, V., & Lee, K. (2002). Development of lying to conceal a transgression: Children's control of expressive behaviour during verbal deception. [Article]. *International Journal of Behavioral Development*, 26(5), 436-444. doi: 10.1080/01650250143000373
- Talwar, V., Lee, K., Bala, N., & Lindsay, R. (2006). Adults’ judgments of children's coached reports. *Law and Human Behavior*, 30(5), 561–570. doi: 10.1007/s10979-006-9038-8

- Talwar, V., Lee, K., Bala, N., & Lindsay, R. C. L. (2004). Children's lie-telling to conceal a parent's transgression: Legal implications. *Law and Human Behavior, 28*(4), 411–435.
- Vredeveltdt, A., Van Koppen, P. J., & Granhag, P. A. (in press). The inconsistent suspect: A systematic review of consistency in truth tellers and liars. In R. H. Bull (Ed.), *Investigative interviewing*. London: Springer.
- Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities* (2nd ed.). New York, NY: Wiley.
- Vrij, A., Akehurst, L., Brown, L., & Mann, S. (2006). Detecting lies in young children, adolescents and adults. *Applied Cognitive Psychology, 20*(9), 1225-1237. doi: 10.1002/acp.1278
- Vrij, A., & Granhag, P. A. (2012). Eliciting cues to deception and truth: What matters are the questions asked. *Journal of Applied Research in Memory and Cognition, 1*(2), 110-117. doi: 10.1016/j.jarmac.2012.02.004
- Vrij, A., Granhag, P. A., Mann, S., & Leal, S. (2011). Outsmarting the liars: Toward a cognitive lie detection approach. *Current Directions in Psychological Science, 20*(1), 28–32. doi: 10.1177/0963721410391245
- Vrij, A., Leal, S., Granhag, P. A., Mann, S., Fisher, R., Hillman, J., & Sperry, K. (2009). Outsmarting the liars: The benefit of asking unanticipated questions. *Law and Human Behavior, 33*(2), 159-166. doi: 10.1007/s10979-008-9143-y
- Vrij, A., Leal, S., Mann, S., & Fisher, R. (2012). Imposing cognitive load to elicit cues to deceit: Inducing the reverse order technique naturally. *Psychology, Crime & Law, 18*(6), 579-594. doi: 10.1080/1068316x.2010.515987

- Vrij, A., Mann, S., Fisher, R., Leal, S., Milne, R., & Bull, R. (2008). Increasing cognitive load to facilitate lie detection: The benefit of recalling an event in reverse order. *Law and Human Behavior, 32*(3), 253–265. doi: 10.1007/s10979-007-9103-y
- Wagenaar, W. A., & Dalderop, A. (1994). *Remembering the zoo: A comparison of true and false stories told by pairs of witnesses*. Unpublished manuscript. Department of Experimental Psychology, Leiden University, The Netherlands.
- Wagenaar, W. A., Van Koppen, P. J., & Crombag, H. F. M. (1993). *Anchored narratives: The psychology of criminal evidence*. New York: St. Martin's Press.

Table 1. Number of consistent, partially consistent, and contradictory responses provided by pairs of children, by type of event (experienced or imagined).

Within-pair consistency				
Event	Consistent	Partially consistent	Contradictory	<i>Total</i>
Experienced	75 (57%)	21 (16%)	36 (27%)	<i>132 (100%)</i>
Imagined	39 (28%)	11 (8%)	88 (64%)	<i>138 (100%)</i>

Note. There were fewer responses in the “experienced” category because one child did not attend the athletics day; hence the consistency of responses for that pair could not be established.

Table 2. Break-down of interview questions, showing the percentage of lying pairs that discussed the question prior to completing the questionnaire, and how well the question discriminated between lying and truth-telling pairs of children.

No.	Interview Question	% of lying pairs who discussed it	Difference between lying and truth-telling pairs
<i>Arts-and-crafts event</i>			
1	Whose mother told the story of Reinaert de Vos?	100%	$\chi^2(1) = .77, p = .38$
2	What did she tell about Reinaert de Vos?	10%	$\chi^2(2) = 6.24, p = .04$
3	Which materials were used for the arts and crafts?	90%	$\chi^2(2) = .79, p = .67$
4	Besides the fox, which other animal did you make?	0%	$\chi^2(2) = 15.95, p < .001^*$
5	Which material was unavailable that day?	0%	$\chi^2(1) = 9.44, p = .002^*$
6	Which intern was in the classroom on that day?	0%	$\chi^2(2) = 3.76, p = .15$
<i>Athletics event</i>			
1	Where was the athletics day?	46%	$\chi^2(2) = 5.22, p = .07$
2	How many different exercises did you do?	0%	$\chi^2(1) = .10, p = .33$
3	Which exercise did you do first?	8%	$\chi^2(2) = 8.76, p = .01$
4	What did you do during the relay race?	0%	$\chi^2(2) = .90, p = .64$
5	With how many groups did your school go through to the next round?	0%	$\chi^2(1) = 5.71, p = .02$
6	Were the children from the other schools all nice?	0%	$\chi^2(1) = 5.71, p = .02$

Note. * Significant at Bonferroni-corrected significance level of $p < .004$.