CHAPTER 8

DECEPTION DETECTION

Aldert Vrij

The importance of detecting deceit in police or intelligence interviews is paramount. Unsurprisingly, throughout history people have attempted to detect deception through observing behavior and analyzing speech, and several nonverbal and verbal lie-detection tools have been developed for this purpose. This chapter describes the two nonverbal tools, the Behavior Analysis Interview (BAI) and lie detection through observing facial emotional expressions, and the two verbal tools, Statements Validity Analysis (SVA) and Scientific Content Analysis (SCAN), that are predominantly used at this point in time.

The BAI is a standardized interview protocol and forms an important first step in police interviewing in the United States. Investigators conduct a BAI to obtain insight into the guilt or innocence of suspects. If the investigator judges the suspect to be guilty, an interrogation may follow. Observing facial emotional expressions, including microexpressions, forms part of security programs implemented in the United States at some international airports. SVA is a systematic method to assess the credibility of children of alleged sexual abuse, and SVA assessments are used as evidence in criminal courts in several West European countries. SCAN is a method to assess written statements produced by suspects, witnesses, or alleged victims and is used by law enforcement, military, and intelligence services across the world.

It will become clear that each of these tools has limitations and that they are not as accurate as their developers claim them to be. In fact, there is no evidence that guilty and innocent suspects respond to the BAI questions in the way BAI investigators claim they do, and research has yet to show that SCAN actually works. SVA can classify truth tellers and liars at accuracy levels above chance but below "reasonable doubt," the standard of proof typically set in criminal courts. A lie-detection tool based on the observation of microexpressions of facial emotions is largely ineffective.

During the last 10 years, two new research trends have become apparent. First, research has emerged demonstrating that interviewers can elicit and enhance nonverbal and verbal cues to deceit via specific questioning techniques. This new wave of "interviewing to detect deception" research is summarized in this chapter. This new research represents a paradigm shift: In the past, anxiety-based lie detection was dominant, but the new literature is predominantly cognitively based. The rationale behind this paradigm shift is also discussed in this chapter.

The second new research trend is a focus on lie detection in intelligence interviews. The occurrence of terrorist attacks and the continuing threat of terrorism have sparked interest in this area, which in several ways differs from lie detection in police interviews about criminal activities, the traditional area of research. This chapter outlines the available intelligence lie detection research. The Practice and Policy Issues section of this chapter includes thoughts about whether the cognitive lie detection approach is too lenient on suspects and the desirability to establish clear decision rules in lie-detection tools.

http://dx.doi.org/10.1037/14462-008
APA Handbook of Forensic Psychology: Vol. 2. Criminal Investigation, Adjudication, and Sentencing Outcomes,
B. L. Cutler and P. A. Zapf (Editors-in-Chief)

The focus of this chapter is lie detection through observation of nonverbal and verbal cues, but lies can also be detected in other ways, such as by measuring people's physiological responses (e.g., skin response, heart rate, blood pressure) or brain activity (brain waves or neural activities). These measurements are intrusive as examinees need to be attached to a polygraph machine to measure heart rate, blood pressure, and skin responses; must undergo electroencephalograms (EEGs) to measure event-related potentials such as the P300 brain wave; or must undergo functional magnetic resonance imaging (fMRI) brain scans to measure neural brain activity. This makes measuring physiological responses and brain activity inapplicable to many real life situations; therefore, they will not be discussed in this chapter. Comprehensive reviews of the polygraph research (Kleiner, 2002; Verschuere, Ben-Shakhar, & Meijer, 2011), P300 research (Rosenfeld, 2011; Vrij & Verschuere, 2013), and fMRI research (Christ, van Essen, Watson, Brubaker, & McDermott, 2009; Gamer, 2011; Vrij & Verschuere, 2013) are available elsewhere.

IMPORTANCE OF THE PROBLEM

In virtually all interviews that the police and intelligence services conduct, investigators need to determine whether a suspect is lying. Those assessments are used to determine further actions. If the police believe that a suspect is lying, they may expose him or her to interrogation techniques meant to break resistance, or they may invest considerable investigative resources into the case to search for conclusive evidence that the suspect is lying. If the SVA expert comes to the conclusion that the child's statement about the alleged sexual abuse is truthful, the alleged perpetrator runs a serious risk of being found guilty in a criminal court, whereas this is less likely to happen if the SVA expert concludes that the statement was fabricated. If intelligence services believe that they can trust an informant, they may act upon the information provided by that informant; if intelligence services do not believe that they can trust a suspect, they may decide not to pay further attention to his or her actions that initially may have been seen as suspicious or odd.

Incorrect veracity judgements can do irreparable harm. Take as example the loss of seven U.S. Central Intelligence Agency (CIA) agents and one Jordanian intelligence officer in Afghanistan on 30 December 2009. The CIA agents were killed in a suicide attack by the informant al-Balawi, who had been recruited by Jordanian intelligence. They thought that al-Balawi was going to give them information about Taliban and Al-Qaeda targets in Pakistan's tribal areas, including Ayman al-Zawahiri, the Al-Qaeda leader at the time. The CIA trusted al-Balawi and therefore did not strip-search him when he arrived at the highly secured CIA base on the Afghan-Pakistan border. The CIA was aware that al-Balawi had posted extreme anti-American views on the internet, but it was decided that the views he had expressed were part of a good cover, and the possibility that they were his real views was discounted (Granhag, 2010; Leal, Vrij, Mann, & Fisher, 2010). Another example is Mohammed Merah, the 23-year-old man who killed three unarmed French soldiers as well as a rabbi, three small children, and a Jewish school teacher in southwest France in March 2012. Merah had long been known as a petty criminal, but his visits to Pakistan and Afghanistan and his links to Islamist extremism drew attention. He was brought in for questioning by French intelligence services in November 2011, but, according to the head of France's intelligence services, his story had been convincing and Merah had shown excellent cooperation, education, and courtesy ("Obituary: Toulouse gunman," 2012; Willsher, 2012).

RELEVANT PSYCHOLOGICAL THEORY AND PRINCIPLES

Traditionally, verbal and nonverbal lie detection has focused on the difference in emotions that liars and truth tellers experience. The core of this anxiety-based approach is that liars are more nervous than truth tellers and therefore will show more nervous behaviors. Ekman's (1985/2001) analysis of facial expressions of emotions is a prime example; the Behavior Analysis Interview is also, in part, based on this premise. The anxiety-approach has not only dominated verbal and nonverbal lie detection, it is also the main approach in

physiological polygraph testing. Emotion/anxiety is generally considered as one of the main correlates of deception (Zuckerman, DePaulo, & Rosenthal, 1981), and there is empirical evidence that liars sometimes do come across as being more nervous than truth tellers (DePaulo et al., 2003), but the approach has serious limitations. First, experiencing emotions is not the sole domain of liars: Truth tellers can experience the same emotions, particularly if they know that they are scrutinized or are afraid of not being believed (Bond & Fahey, 1987; Ofshe & Leo, 1997). Second, if emotional displays or cues of nervousness per se do not reliably distinguish between truth tellers and liars, perhaps questions can be asked that will elicit such cues in liars but not in truth tellers or, alternatively, that will enhance such cues more in liars than in truth tellers. No such questioning technique exists to date, and it is doubtful that it can ever be developed (National Research Council, 2003).

In recent years, researchers have concentrated on cognitive lie detection. The premise is that lying is mentally more taxing than truth telling (Vrij, Fisher, Mann, & Leal, 2006). Cognition is also considered as one of the main correlates of deception (Zuckerman et al., 1981), and there is empirical evidence that liars sometimes do show signs of thinking hard (DePaulo et al., 2003). This approach shares one limitation with the emotion approach: Cues of cognitive load are not the sole domain of liars either; truth tellers also may have to think hard, and therefore they may display cues of being mentally taxed (DePaulo et al., 2003). Unlike the emotion approach, however, interview protocols that elicit and enhance cues of cognitive load more in liars than in truth tellers can be developed, making it possible to discriminate between the two (Vrij & Granhag, 2012a). Three approaches discussed in this chapter—imposing cognitive load, asking unanticipated questions, and the strategic use of evidence—are examples of cognitive lie-detection techniques. The latter technique also takes into account the notion that liars use different strategies to avoid detection than do truth tellers (Granhag & Hartwig, 2008). In sum, in verbal and nonverbal lie detection, the emphasis has moved in recent years from emotion-based lie-detection techniques to cognitive-load lie-detection techniques that focus on liars' and truth tellers' different psychological states and take their differential strategies into account.

Apart from the fact that liars may experience emotions and cognitive load, a third aspect often plays a role in lie-detection techniques: Liars are more concerned than truth tellers with impression management and are therefore, compared to truth tellers, keener to construct a report or show behavior that they believe will make a credible impression on others and will leave out information or avoid showing behavior that, in their view, will damage their image of being a sincere person (Zuckerman et al., 1981). This leads to liars attempting to show responses that they believe appear honest and to avoid showing responses that they believe appear suspicious (Hocking & Leathers, 1980; Köhnken, 2004). This impression management approach is particularly present in the SVA verbal veracity tool.

RESEARCH REVIEW

This section summarizes the available nonverbal and verbal lie detection research. First, the two nonverbal tools, the Behavior Analysis Interview (BAI) and lie detection through observing facial emotional expressions, and the two verbal tools, Statements Validity Analysis (SVA) and Scientific Content Analysis (SCAN), that are mostly used at this point in time are discussed. This is followed by a discussion of two new and promising trends in (non) verbal deception research: Interviewing to detect deception, and lie detection in intelligence interviews.

Nonverbal Lie-Detection Tools

Analyses of nonverbal behavior have a long history, and the assumption was that fear of being detected was an essential element of deception and lie detection. In a Hindus writing from 900 BC, it is mentioned that liars rub the great toe along the ground and shiver, and that they rub the roots of their hair with their fingers (Trovillo, 1939). More detailed and systematic analyses of nonverbal cues to deceit emerged in the second half on the twentieth century, with Reid and Arther's (1953) analysis of

the behavior of more than 800 suspects being one of the front runners. Reid and Arther's observations, together with Horvath's (1973) work regarding nonverbal cues to deceit, resulted in the development of the BAI, the nonverbal lie-detection tool that will be described first.

Behavior Analysis Interview. The BAI is developed and taught by John E. Reid and Associates, a U.S. firm that provides training in interrogation and interviewing. The BAI is described in John E. Reid and Associates' manual (Inbau, Reid, Buckley, & Jayne, 2013), which is now in its fifth edition. On their website, John E. Reid and Associates report that, since it was first offered in 1974, more than 300,000 professionals have attended the three-day interviewing and interrogation training of which BAI forms a part. Trainees come from the private and public sector and are from across the world.

Different rationales exist as to why truth tellers and liars would display different responses in a BAI. One explanation is that liars feel less comfortable than truth tellers during an investigative interview (Inbau et al., 2013); other explanations are that liars lack understanding of how truth tellers actually behave and that liars are reluctant to share much information out of fear that it will lead to deception detection (Horvath, Blair, & Buckley, 2008).

The BAI forms an important first step in U.S. police interviewing. Police investigators who are reasonably certain of a suspect's guilt may submit the suspect to persuasive interrogation techniques meant to break down resistance (see Chapter 9, this volume for a review of interrogations and confessions). Because such interrogation techniques may lead to false confessions, it is important to avoid submitting innocent suspects to these techniques. Therefore, investigators conduct a BAI to obtain insight into the innocence or guilt of suspects. Investigators form a judgement about this based on the suspect's nonverbal and verbal responses during the BAI. If the investigator judges the suspect to be deceptive, an interrogation may follow.

The BAI protocol includes asking investigative, nonthreatening questions and behavior-provoking questions (Buckley, 2012). The former type of question forms part of most interview protocols, and it is the latter type of question that makes the BAI stand out from other interview protocols. There are 14 predetermined and standardized behavior-provoking questions, including a question whether the suspect committed the crime him/herself and a question whether the suspect knows who has committed the crime. In the BAI it is assumed that guilty suspects are more likely than truth tellers to display nervous or anxiety-reducing behavior, such as crossing their legs, shifting about in their chair, and performing grooming behavior while answering the question, whereas innocent suspects are more likely than guilty suspects to lean forward, establish eye contact, and use illustrators to reinforce their confidence in their statements. In addition, guilty suspects are more likely to answer quickly, and their answers will sound less sincere.

Horvath, Jayne, and Buckley (1994) tested the efficiency of the BAI in a field study. The study included 60 videotaped interviews with real suspects in which the BAI protocol was used and the investigators made veracity judgments. When inconclusive outcomes were disregarded, an overall accuracy rate of 86% was obtained. This is an impressive accuracy rate, but the study had an important limitation in that the ground truth was unclear. That is, it could not be established with certainty that the innocent suspects were truly innocent and the guilty suspects were truly guilty, a widespread and well documented problem in deception field studies (Iacono, 2008). In fact, Horvath et al. (1994) reported that the ground truth was established by "incontrovertible evidence" in only two of the 60 cases that they analyzed. They concluded that, "if it were possible to develop ground truth criteria in a large number of cases such as occurred in these two instances, the interpretation of findings would be less problematic" (p. 805). This conclusion probably does not go far enough. The results of a study in which the ground truth is established in only 3% of the cases (two out of 60 cases) are simply unreliable.

Other studies provide less flourishing results for the BAI both in terms of the nonverbal cues to deceit that emerge in (BAI) interviews and the ability to detect deceit when paying attention to the BAI cues.

We tested the working of BAI in a controlled laboratory experiment, and our results directly refuted Inbau et al.'s (2013) predictions about how liars behave: Liars were less likely to cross their legs and less likely to shift posture than truth tellers (Vrij, Mann, & Fisher, 2006). In addition, Inbau et al.'s (2013) predictions about how liars behave are not supported by DePaulo et al.'s (2003) meta-analysis of more than 150 studies about nonverbal and verbal cues to deception. Inbau et al.'s (2013) predictions are, however, in alignment with how observers believe liars behave (Masip, Barba & Herrero, 2012; Masip & Herrero, 2013; Masip, Herrero, Garrido, & Barba, 2011). Moreover, in Kassin and Fong's (1999) experiment, half of the observers received training in the visual BAI cues. The trained observers' performance on a subsequent lie-detection test was worse than that of untrained participants. This finding, that paying attention to the visual BAI cues impairs lie detection performance, was supported by a field study where police officers judged the veracity of statements made by murder, rape, and arson suspects who told the truth and lied during their real-life (videotaped) police interviews (Mann, Vrij, & Bull, 2004). The police officers were also asked which cues they pay attention to when they attempt to detect deceit. Mann et al. (2004) found a negative relationship between officers reportedly attending to the BAI cues (e.g., averting gaze, shifting posture, making self-adaptors, etc.) and accuracy in the lie-detection task. That is, the more the officers endorsed the BAI's view on cues to deception, the worse they became at distinguishing between truths and lies. In other words, there is evidence that endorsing the information about visual cues to deception discussed in the BAI protocol is counterproductive and makes people worse lie detectors.

Lie detection through the observation of facial expressions. Over the years, Paul Ekman, an American psychologist and pioneer in the study of emotions and their relation to facial expressions, has argued that facial expressions of emotion betray liars (Ekman, 1985/2001). According to Ekman (Henig, 2006), aspects of facial communication are beyond control and can betray a deceiver's true emotion via microexpressions (lasting 1/25 to 1/5 of a second) of that emotion. Ekman has claimed that his system of lie detection, which includes the observation of facial expressions of emotions, including microexpressions, can be taught to anyone with an accuracy of more than 95%. Ekman's lie detection method forms part of the security program SPOT (Screening Passengers by Observational Techniques), which is implemented in the United States, including at Boston's Logan International Airport (Ekman, 2006).

Worryingly, Ekman has never published empirical data showing that facial (micro)expressions of emotions are diagnostic indicators of deceit or that observers achieve 95% accuracy when paying attention to such expressions. The former has been investigated by a group of Canadian researchers: In an experimental laboratory study, Porter and ten Brinke (2008) found that microexpressions of emotions occurred in only 14 out of the 697 analyzed facial expressions, and that six of those 14 microexpressions were displayed by truth tellers. In a second experimental laboratory study, microexpressions again only occurred in a minority of cases and were again equally common in truth tellers and liars (ten Brinke, MacDonald, Porter, & O'Connor, 2012). Those findings suggest that a lie-detection tool based on microexpressions of facial emotions is largely ineffective.

Someone may argue that facial (micro)expressions of emotions only occur when there are severe consequences for the liar when the lie fails, which is never the case in laboratory studies. In another research project, the same group of Canadian researchers examined the facial expressions (rather than microexpressions) of 52 individuals who pleaded on television to the public for the return of their missing relative, half of whom were convicted of murdering that person. In other words, this was a true high-stakes situation. Muscles associated with grief (*corrugator supercilii* and *depressor anguli oris*) were more often contracted in genuine pleaders than in deceptive pleaders, and full contractions of the *frontalis* (failed attempts to appear sad) occurred more frequently in liars than in truth tellers. On the basis of these behaviors, however, only a modest number of liars (around 56%) and more truth tellers (around 82%) were classified correctly, resulting in

a modest 69% overall accuracy (ten Brinke, Porter, & Baker, 2012). In a second paper about this high-stakes situation, the facial expressions of 78 individuals (including the 52 individuals from ten Brinke, Porter, & Baker, 2012) were examined (ten Brinke & Porter, 2012). More liars than truth tellers expressed disgust, surprise, and happiness, whereas more truth tellers than liars expressed sadness. The percentages were not impressive, however, and the total classifications of truth tellers and liars based on these expressions fell in the 60%–70% range. Those findings do not support Ekman's claim that facial (micro)expressions of emotions can classify correctly more than 95% of truth tellers and liars. In addition, the high-stakes situation in which the facial expressions of emotion were examined create optimum conditions for these expressions to occur. Many real-life situations involve lower stakes, and in such situations facial expressions of emotions will occur less frequently (or not at all), leading to less than 60%–70% accuracy.

Verbal Lie Detection

There is not much history in analyzing speech. A Hindus writing of 900 BC referred to speech by saying that liars do not answer questions or are evasive (Trovillo, 1939). In other words, it refers to the absence of speech. The notion that the presence of speech can indicate deceit arose much later, and early systematic analyses of speech started to arrive in the 1950s in Germany (Undeutsch, 1982) and Sweden (Trankell, 1972). In 1954 the Supreme Court of West Germany summoned a small number of experts to a hearing. The Court wanted to assess to what extent psychologists could help in determining the credibility of child witnesses' testimonies, particularly in trials for sexual offences (see Volume 1, Chapter 11, this handbook for a review of sexual offending and Chapter 1, this volume for a review of child witnesses). The forensic psychologist Udo Undeutsch (1989) reported the case of a 14-year-old alleged victim of rape that he had investigated, and the five Justices of the Senate were impressed by his analysis. Subsequently a ruling was made in 1955 by the German Supreme Court that required the use of psychological interviews and assessments of credibility in virtually all contested cases of child sexual abuse. This led to numerous cases in which psychologists were called on as experts. Arntzen (1982) estimated that by 1982 expert testimony had been offered in more than 40,000 cases.

In West Germany and Sweden, this resulted in the further development of various content criteria to assess the credibility of statements made by alleged victims of sexual abuse. Undeutsch (1982) was the first to compile a comprehensive list of criteria, but others have published similar lists (Vrij, 2008). The German scholars Günter Köhnken and Max Steller took statement analysis a step further. They refined the available criteria and integrated them into a formal assessment procedure, the SVA, which they published in English (Köhnken & Steller, 1988; Steller & Köhnken, 1989). Of the nonverbal and verbal veracity tools, SVA assessment outcomes are the only ones accepted as evidence in some North American courts and in criminal courts in several West-European countries, including Germany, the Netherlands, and Sweden (Vrij, 2008). The introduction of SVA has resulted in a large number of experimental studies examining one stage of this tool, criteria-based content analysis (CBCA). This section presents an outline of SVA and a discussion of the results of these experimental CBCA studies.

During the late 1980s, another verbal veracity tool originated, Scientific Content Analysis (SCAN). This tool has attracted considerably less interest from researchers, and there is very little SCAN research to date. SCAN is frequently used by practitioners, however, which makes it appropriate for discussion in this chapter. This section briefly outlines SCAN together with the available SCAN research.

Statement Validity Analysis. SVA was designed to determine the credibility of child witnesses' testimonies in trials for sexual offences. It is not surprising that a technique has been developed to verify whether a child has been sexually abused. It is often difficult to determine the facts in an allegation of sexual abuse, because often there is no medical or physical evidence. Frequently the alleged victim and the defendant give contradictory testimony, and often there are no independent witnesses to

give an objective version of events. This makes the perceived credibility of the defendant and alleged victim important. The alleged victim is in a disadvantageous position if he or she is a child, as adults have a tendency to mistrust statements made by children.

SVA consists of four stages (Vrij, 2008): (1) a case-file analysis, (2) a semistructured interview, (3) a CBCA that systematically assesses the quality of the transcribed interviews, and (4) an evaluation of the CBCA outcome via a set of questions (Validity Checklist).

The case-file analysis (stage 1) considers information about the child witness (e.g., age, cognitive abilities, relationship to the accused person), the nature of the event in question, and previous statements of the child and other parties involved. This gives the SVA expert insight into what may have happened and the issues under dispute. The three subsequent stages focus on these disputed elements. In stage 2, the interview, the child provides his or her own account of the allegation. Interviewing young children is difficult, because their descriptions of past events are notably incomplete. Special interview techniques based upon psychological principles have been designed to obtain as much information as possible from interviewees in a free narrative style (see Bull, 2010; Fisher, 2010).

The core of the technique is stage 3, in which trained evaluators perform the CBCA to assess the presence of 19 different criteria in the transcribed interview (Köhnken & Steller, 1988; Steller & Köhnken, 1989). Each of these 19 criteria is assumed to occur more frequently in truthful than in deceptive accounts. According to CBCA/SVA theory, some criteria are likely to indicate genuine experiences because these criteria are typically too difficult to fabricate (Köhnken, 1996, 2004). Therefore, statements that are coherent and consistent (logical structure), whereby the information is not provided in a chronological time sequence (unstructured production) and which contain a significant amount of detail (quantity of detail) are more likely to be true. CBCA makes a further distinction between 10 different types of detail (criteria 4–13), which are also considered indicators of truthfulness. Criteria include contextual embeddings (references to time and space: "He approached me for the first time in the garden during the summer holidays."), descriptions of interactions (statements that link at least two actors with each other: "The moment my mother came into the room, he stopped smiling."), reproduction of speech (speech in its original form: "And then he asked: Is that your coat?"), accounts of subjective mental state (when the witness describes his or her feelings or thoughts experienced at the time of the incident), and attribution of perpetrator's mental state (when the witness gives their interpretation of the perpetrator's feelings, thoughts, or motives during the incident).

Other criteria (criteria 14–18) are more likely to occur in truthful statements for motivational reasons. Truthful persons will not be as concerned with impression management as deceivers. Compared to truth tellers, deceivers will be keener to construct a report that they believe will make a credible impression on others, and will leave out information that, in their view, will damage their image of being a sincere person (Köhnken, 1996, 2004). As a result, a truthful statement is more likely to contain information that is inconsistent with the stereotypes of truthfulness. The CBCA list includes five of these so-called "contrary-to-truthfulness-stereotype" criteria (Ruby & Brigham, 1998), including: spontaneous corrections (corrections made without prompting from the interviewer), and admitting lack of memory (expressing concern that some parts of the statement may be incorrect: "I think," "Maybe," "I am not sure," etc.). Although SVA is designed to evaluate children's testimonies in alleged sexual abuse cases, some scholars have argued that the technique can also be used to evaluate the testimonies of adults who talk about issues other than sexual abuse as the underlying factors of cognitive load and impression management also apply to adults (Köhnken, 2004; Porter & Yuille, 1996; Ruby & Brigham, 1997). Research findings have supported this view (Vrij, 2008)

CBCA has been widely researched, and more than 50 empirical studies about this method have been published to date (Vrij, 2008). Those studies demonstrate that CBCA analyses can be useful for lie-detection purposes. In 20 studies, researchers computed total CBCA scores and compared these

scores for truth tellers and liars. In 16 of 20 studies (80%), the hypothesis that truth tellers will obtain significantly higher total CBCA scores than liars was supported. Regarding the individual criteria, criterion 3 (quantity of details) received the most support. The amount of details was calculated in 29 studies, and in 22 of those (76%) truth tellers included significantly more details in their accounts than liars. Moreover, in not a single study did truth tellers include significantly less details in their statements than liars. Finally, the extent to which CBCA analyses can discriminate liars from truth tellers was examined in 24 studies. The average accuracy rate in these studies was 71%. In other words, there is evidence that CBCA can be effective in discriminating between truths and lies.

All of these studies were laboratory studies, however, and there are reasons to believe that the use of SVA is more difficult in real life. The problem is that CBCA scores are affected by factors other than the veracity of the statement. For example, older children produce statements that typically contain more CBCA criteria than younger children (Buck, Warren, Betman, & Brigham, 2002), statements are unlikely to contain many CBCA criteria if the interviewer did not give the child enough opportunity to tell the whole story (Hershkowitz, Lamb, Sternberg, & Esplin, 1997), and highly suggestible children may give an inaccurate account when leading questions are asked (Bull, 2010; Fisher, 2010). The fourth and final phase of the SVA method is to examine whether any of these alternative explanations may have affected the presence of the CBCA criteria in the transcripts. For this purpose, the Validity Checklist has been compiled and comprises 11 factors that are thought to possibly affect CBCA scores. By systematically addressing each of the factors addressed in the Validity Checklist, the evaluator explores and considers alternative interpretations of the CBCA outcomes.

There are reasons to believe that applying the Validity Checklist can be problematic. Some factors, such as susceptibility to suggestion, are difficult to measure. To examine a child's susceptibility to suggestion, the interviewer should ask the witness a few leading questions at the end of the interview (Yuille, 1988; see Chapter 1, this volume for a review of children as witnesses). At this point, interviewers should only ask questions about irrelevant peripheral information, because asking questions about central information could damage the quality of the statement. Being allowed only to ask questions about peripheral information is problematic, as it may say little about the witness' suggestibility regarding core issues of his or her statement, because children show more resistance to suggestibility for central parts than peripheral parts of an event (Dalton & Daneman, 2006). In addition, it is difficult, if not impossible, to determine the exact impact of many factors on CBCA scores. For example, in one study SVA raters were instructed to take the age of the child into account (a factor that appears on the Validity Checklist) when calculating CBCA scores (Lamers-Winkelman & Buffing, 1996). Nevertheless, several criteria positively correlated with age.

Given these difficulties in measuring the factors and in examining the exact impact of these factors on CBCA scores, it is clear that the Validity Checklist procedure is more subjective and less formalized than the CBCA procedure. It is therefore not surprising that, if two experts disagree about the truthfulness of a statement in a German criminal case, they are likely to disagree about the likely impact of Validity Checklist issues on that statement (Vrij, 2008). One field study revealed that Swedish experts sometimes use the Validity Checklist incorrectly, which could be due to the difficulties with applying it (Gumpert & Lindblad, 2000). First, although SVA experts sometimes highlight the influence of Validity Checklist factors on children's statements in general, they do not always discuss how these factors may influence the statement of the particular child they are asked to assess. Second, although experts sometimes indicate possible external influence on statements, they are inclined to rely upon the CBCA outcome and tend to judge high-quality statements as truthful and low-quality statements as fabricated.

In sum, although SVA assessments are used as evidence in (criminal) courts to evaluate the veracity of child witnesses' testimonies in trials for sexual offences, the accuracy of these assessments is unknown. Research has shown that CBCA assessments distinguish truths from lies with 71%

accuracy, but the use of the Validity Checklist is problematic for a variety of reasons.

Scientific Content Analysis. Scientific Content Analysis (SCAN) was developed by the former Israeli police lieutenant and polygraph examiner Avioam Sapir (1987/2000). SCAN is used all over the world (Vrij, 2008) by federal law enforcement (including the U.S. Federal Bureau of Investigation), military agencies (including the U.S. Army Military Intelligence), secret services (including the CIA), and other types of investigators (including social workers, lawyers, fire investigators, and the American Society for Industrial Security; Bockstaele, 2008).

Typically, a SCAN analysis starts with asking the suspect, witness, or alleged victim to write down "everything that happened" during a particular time frame. This account is referred to as a pure version of the event and has to be produced without the presence and interference of an investigator to minimize investigator influences. The SCAN expert then evaluates the statement. There is no standardized set of SCAN criteria, but 12 criteria have been used in research (Nahari, Vrij, & Fisher, 2012).

Sapir (1987/2000) claims that some SCAN criteria are more likely to occur in truthful than in deceptive statements (e.g., denial of allegations, use of self-references), whereas other criteria are more likely to occur in deceptive than in truthful statements (e.g., change in language, missing information). The SCAN literature does not mention an underlying theoretical rationale for these predictions or a rationale for why criteria are included in the SCAN list. Examination of the SCAN criteria gives the impression that SCAN is based at least in part on a motivational approach in which liars attempt strategically to select the exact words that reflect their knowledge but hide their guilt. For example, at least four criteria explicitly deal with what the examinee did not say or concealed. Within the missing information criterion, SCAN experts look for words or phrases such as "finally," "later on," or "some time after," which can imply that some information is left out. Another SCAN criterion referring to hiding guilt is objective and subjective time. Here, the proportions of the actual durations of the activities (objective time) are compared with the number of words that the examinee used to describe these activities (subjective time). When the subjective time is shorter than the objective time, it may imply that the examinee is attempting to conceal information regarding that activity.

SCAN users refer to Driscoll's (1994) field study as evidence that SCAN works. Indeed, the accuracy rate obtained in that study was high at 83%, but a serious limitation of the study was that the ground truth could not be established. Nahari et al. (2012) tested the efficiency of SCAN in a laboratory experiment. Truth tellers truthfully wrote down their activities during the last half hour, whereas liars were asked to fabricate a story. The statements were analyzed with SCAN and, by way of comparison, also with Reality Monitoring (RM), a verbal veracity tool used by deception researchers but not used in the field (Masip, Sporer, Garrido, & Herrero, 2005; Vrij, 2008). SCAN did not distinguish truth tellers from liars above the level of chance but RM did. With RM analyses, 71% of truth tellers and liars were correctly classified.

Smith (2001) also published a SCAN field study in which she asked SCAN users and experienced detectives not trained in SCAN to judge 27 statements. The SCAN users could give truthful, deceptive, or inconclusive verdicts, and correctly classified 80% of the truths and 75% of the lies. This sounds impressive, but the group of experienced detectives untrained in SCAN obtained accuracy rates that did not differ significantly from these accuracy rates. In other words, knowledge of SCAN did not lead to a superior ability in distinguishing truths from lies. Moreover, as in Driscoll's study, the ground truth for all cases was uncertain. Armistead (2011) claims that Smith's (2001) conclusion that SCAN users were as accurate as experienced detectives untrained in SCAN was not supported by her data, but the lack of ground truth makes interpreting the accuracy rates problematic anyway.

Smith (2001) further examined whether different SCAN users were using the same criteria when applying SCAN. This is an important standardization question and a lack of ground truth does not affect the results. Smith found that different experts used different SCAN criteria to justify their decision of whether a statement was deceptive. In other

words, there was a lack of consistency in the application of SCAN amongst SCAN users.

There is some overlap between SCAN and CBCA in the criteria that are examined. For example, the spontaneous corrections, lack of memory, and extraneous information criteria appear on both lists. Intriguingly, the predictions about how these criteria differ between truth tellers and liars vary. In CBCA the occurrence of those cues are perceived as indictors of truth, whereas in SCAN the same criteria are seen as indicators of deceit. Research regarding these individual criteria gives support only to the CBCA assumptions (Vrij, 2008).

In sum, SCAN is popular among practitioners and is widely used, but there is not much SCAN research available, and the research that exists has yet to demonstrate that SCAN analyses can distinguish truth tellers from liars. In addition, there are reasons to believe that there is a lack of consistency among SCAN users in applying the method.

Interviewing to Detect Deception

In physiological lie detection it has been acknowledged for a long time that the type of questioning matters. For example, the Relevant–Irrelevant polygraph test is widely criticized for asking the wrong questions (Kleiner, 2002). The rationale behind the Relevant–Irrelevant test is that deception will increase arousal. This increased arousal becomes apparent in increased heart rate, blood pressure, and skin response that will be detected by the polygraph machine. As such, the Relevant–Irrelevant Test is an anxiety-based lie-detection test. In the test, physiological responses to relevant questions (e.g., "On March 13, 2011, did you kill Julie Appletoddler?") are compared with physiological responses to irrelevant questions (e.g., "Is it today Tuesday?"), to which the examinee is instructed to give a truthful answer. Guilty examinees who deny their guilt will lie in response to the relevant question and will tell the truth in response to the irrelevant question. The relevant question should thus result in higher arousal levels than the neutral question according to the Relevant–Irrelevant test's "deception increases arousal" rationale. Truth tellers will tell the truth in response to both questions and their arousal levels should therefore not differ between the two types of question. The test is highly criticized because it puts truth tellers at risk. There are good reasons why truth tellers might react strongly to the relevant questions, such as out of fear not to be believed. In the polygraph community the debate is ongoing whether an anxiety-based physiology test can be devised that resolves the problem of truth tellers also showing increased arousal to the relevant questions than the control questions. Most people in the academic world think that such a test cannot be composed (Iacono & Lykken, 1997), and the National Research Council (2003) is skeptical.

Only in the last 10 years it has been acknowledged that questioning also matters in nonverbal and verbal lie detection, and research about effective interview techniques has started to emerge. Based on the problems associated with anxiety-based tests that emerged in the physiological lie-detection debate, a new, cognitive approach is pursued. The assumption is that it is possible to ask questions that raise cognitive load more in liars than in truth tellers. Three cognitive lie detection approaches have emerged to date, the imposing cognitive load, asking unanticipated questions, and strategic use of evidence approaches. They are outlined in this section.

Imposing cognitive load. Sources varying from self-reports to fMRI research have shown that lying is often more cognitively demanding than truth telling (Vrij, Fisher, et al., 2006; Vrij, Granhag, Mann, & Leal, 2011; Vrij, Granhag, & Porter, 2010). Factors that contribute to the increased cognitive load include formulating the lie; the liar's inclination to monitor and control his demeanor in order to appear honest to the investigator; the liar's inclination to monitor the investigator's reactions carefully in order to assess whether he appears to be getting away with the lie; the liar's need to suppress the truth whilst he is fabricating; and the fact that activation of the truth often happens automatically, whereas activation of the lie is more intentional and deliberate.

An investigator could exploit the differential levels of cognitive load that truth tellers and liars experience to discriminate more effectively between them. Liars who require more cognitive resources

than truth tellers will have fewer cognitive resources left over. If cognitive demand is further raised, which could be achieved by making additional requests such as telling a story in reverse order or maintain eye contact with the interviewer, liars do not cope with these additional tasks as well as truth tellers. As a result, more cues to deception occur, and observers are better at detecting deceit (Vrij et al., 2008; Vrij, Mann, Leal, & Fisher, 2010). For example, in the reverse-order experiment in which truth tellers and liars either recalled an alleged activity in reverse order or in normal chronological time order (Vrij et al., 2008), nine cues to deceit emerged in the reverse-order condition compared to one cue in the chronological time order (control) condition. In the reverse-order condition, observers could detect lies with 60% accuracy compared to a 42% accuracy rate in the control condition.

An alternative way to impose cognitive load on liars is to ensure that truth tellers will provide more information in a given interview setting. Talkative truth tellers raise the standard for liars, who also need to become more talkative to match truth tellers. Liars may be reluctant to add more information out of fear that it gives their lies away. They also may find it too difficult or lack the imagination to add as many details as truth tellers do, or what information they do add may be of lesser quality or may sound less plausible. We recently successfully tested one way of increasing the amount of detail truth tellers generate. In the experiment, two interviewers were used (Mann et al., 2013). The second interviewer was silent but showed different demeanors during the interview. In one condition he was supportive throughout (e.g., nodding his head and smiling); in a second condition he was neutral, and in a third condition he was suspicious (e.g., frowning). Being supportive during an interview facilitates talking and encourages cooperative witnesses (e.g., truth tellers) to talk (Memon, Meissner, & Fraser, 2010; Bull, 2010; Fisher, 2010). Indeed, truth tellers provided most detail in the supportive condition, and only in that condition did they provide significantly more detail than liars (Mann et al., 2013). Based on detail, 71% of truth tellers and liars were correctly classified in the supportive condition compared to 55% in the neutral condition.

In sum, imposing cognitive load can be achieved in two different ways: first, by using interventions that increase the difficulty to recall information (reverse order and maintaining eye contact), and, second, by using interventions that makes examinees more talkative.

Asking unanticipated questions. A consistent finding in deception research is that liars prepare themselves when anticipating an interview (Hartwig, Granhag, & Strömwall, 2007). This strategy makes sense. Planning makes lying easier, and planned lies typically contain fewer cues to deceit than do spontaneous lies (DePaulo et al., 2003). The positive effects of planning, however, will only emerge if liars correctly anticipate the questions that will be asked. Investigators can exploit this limitation by asking questions that liars do not anticipate. Though liars can refuse to answer unanticipated questions, such "I don't know" or "I can't remember" responses will create suspicion if the questions are about central (but unanticipated) aspects of the target event. To test the unanticipated-questions technique, pairs of liars and truth tellers were interviewed individually about an alleged visit to a restaurant (Vrij et al., 2009). The conventional opening questions (e.g., "What did you do in the restaurant?") were anticipated, whereas spatial questions (e.g., "Where did you and your friend sit?") and the request to sketch the layout of the restaurant were not. (Anticipation was established with the interviewees after the interview.) Based on the overlap (similarity) in the pair members' drawings, 80% of the liars and truth tellers were classified correctly (the drawings were less alike for the pairs of liars than pairs of truth tellers), whereas on the basis of the conventional questions the pairs were not classified above chance level. A difference in overlap between anticipated and unanticipated questions further indicated deceit. Pairs of truth tellers showed the same amount of overlap in their answers to the anticipated and unanticipated questions, whereas liars showed significantly more overlap in their answers to the anticipated questions than in their answers to the unanticipated questions.

Comparing the answers to anticipated and unanticipated questions can also be used to detect

deceit in individual liars. In an experiment by Warmelink, Vrij, Mann, Jundi, and Granhag (2012), truth tellers and liars (who were given the opportunity to prepare themselves) were interviewed about their alleged forthcoming trip. Expected questions about the purpose of the trip (e.g., "What is the main purpose of your trip?") were followed by unexpected questions about transport (e.g., "How are you going to travel to your destination?"), planning ("What part of the trip was easiest to plan?"), and the core event ("Keep in mind an image of the most important thing you are going to do at this trip. Please describe this mental image in detail."). The hypothesis was that liars are likely to have prepared answers to the expected questions and may therefore be able to answer them in considerable detail. Liars will not have prepared answers for the unexpected questions and may therefore struggle to generate detailed answers to them. Indeed, compared to truth tellers, liars gave significantly more detail to the expected questions and significantly less detail to the unexpected questions.

The strategic use of evidence. Lying and truthful suspects enter police interviews with different mental states (Granhag & Hartwig, 2008). Guilty suspects will often have unique knowledge about the crime, which, if recognized by the interviewer, makes it obvious that they are the perpetrators. Their main concern will be to ensure that the interviewer does not gain that knowledge. In contrast, innocent suspects face the opposite problem, fearing that the interviewer will not learn or believe what they did at the time of the crime. These different mental states result in different counter-interrogation strategies for liars and truth tellers (Hartwig et al., 2007). Guilty suspects are inclined to use avoidance strategies (e.g., in a free recall, they may avoid mentioning that they were at a certain place at a certain time) or denial strategies (e.g., they may deny having been at a certain place at a certain time when directly asked). In contrast, innocent suspects neither avoid nor escape but are forthcoming and "tell the truth like it happened" (Granhag & Hartwig, 2008).

When investigators possess critical and possibly incriminating background information (evidence) in a case, they can exploit these differential truth tellers' and liars' strategies by introducing the available evidence during the interview in a strategic manner, known as the Strategic Use of Evidence technique (SUE). When questions about the evidence are asked, the forthcoming innocent suspects will be more consistent with the available evidence than the avoidant/denying guilty suspects.

In the SUE technique, three groups of tactics are relevant: evidence tactics, question tactics, and disclosure tactics (Granhag, Strömwall, Willén, & Hartwig, 2013). The evidence tactics are used primarily to assess the evidence in the planning phase; the question tactics are used systematically to exhaust the alternative explanations that a suspect may have to account for the evidence; and the disclosure tactics are used to maximise the diagnostic value of the evidence. Granhag et al. (2013) tested the so-called Evidence Framing Matrix, which is an example of a disclosure tactic. This matrix suggests that when one piece of evidence is disclosed, two dimensions are particularly helpful in illuminating the different framing alternatives that exist: the strength of the source of the evidence, which can vary from weak to strong, and the degree of precision of the evidence, which can vary from low to high. Granhag et al. (2013) found that using this matrix to reveal the evidence in a stepwise manner, moving from the most indirect form of framing (weak source/low specificity, e.g., "We have information telling us that you recently visited the central station.") to the most direct form of framing (strong source/high specificity, e.g., "We have CCTV footage showing that you collected a package from a deposit box at the central station, ground floor level, on the 24th of August at 7.30 p.m."), elicited more and stronger cues to deception than using the most direct form of framing only. In other words, it was found that both when and how the evidence was disclosed moderated the effectiveness of disclosure. It was most effective to disclose the evidence late rather than early in the interview, and it was most effective when the evidence became progressively stronger and more precise.

Hartwig, Granhag, Strömwall, and Kronkvist (2006) tested the SUE technique at a Swedish police academy. Swedish police trainees, half of whom

were trained in the SUE technique, interviewed mock suspects who had or had not stolen a wallet from a briefcase. The SUE trained interviewers obtained 85.4% accuracy, whereas the untrained interviewers obtained 56.1% accuracy. In addition, the liars' answers were more inconsistent with the evidence than the truth tellers' answers. The SUE technique has been found to be successful in eliciting cues to deception for lying adults and lying children, for lying single suspects and lying multiple suspects, and for suspects lying about their past actions and lying about their intentions (Vrij & Granhag, 2012a).

Lie Detection in Intelligence Interviews

Terrorist attacks across the world and the continuing threat of such attacks have made the urge to prevent them paramount. Gathering information to prevent terrorist attacks often comes from interviewing people (Loftus, 2011), and in such interviews lie detection can be important (Loftus, 2011). It requires interviewing known and potential terrorists, or other people who may possess valuable information. The threat of terrorism has further led to an increased emphasis on the detection of deception in public spaces, such as country borders, security checkpoints, bus terminals, train stations, shopping malls, and sports venues (Cooke & Winner, 2008; Driskell, Salas, & Driskell, 2012). Deception detection in intelligence interviews differs in several ways from deception detection in police suspect interviews, the traditional domain of forensic deception research (Vrij & Granhag, 2012a; Vrij, Granhag, & Porter, 2010). For example, in police interviews investigators typically focus on a suspect's past activities, but in intelligence interviews investigators are often interested in someone's future activities (e.g., intentions). Another difference in intelligence interviews is that investigators, particularly those who are working in an undercover capacity, sometimes have good reason not to tell the interviewees that the "chat" they have with them is in fact an interview. A third difference is that terrorist acts are often planned and executed by groups rather than individuals. A fourth difference is that police suspect interviews are typically focused on solving crimes through obtaining admissions or confessions from suspects, whereas intelligence interviews are more about gathering information (Brandon, 2011).

Intentions. Most forensic deception research deals with lying about past activities. This makes sense because most of that research focuses on police interviewing, and the police mostly interview suspects about their alleged past activities. In counterterrorism, however, being able to discriminate between true and false accounts about future activities (e.g., intentions) is of paramount importance, as this addresses the issue of preventing criminal acts from occurring. An example of the negative consequences that arise if an offender is falsely believed is given in the Importance of the Problem section.

Deception research about intentions has commenced (see Granhag, 2010, for an overview), and the pattern that emerges from these experiments is that intentions reveal different verbal cues to deceit than past activities. For example, the verbal criterion "detail," a diagnostic cue to deceit when interviewees discuss their past activities, is less likely to emerge as a cue to deceit when interviewees discuss their future activities (Vrij, Leal, Mann, & Granhag, 2011). One aspect that often makes truth tellers' stories about past activities more detailed than liars' is that there is a wealth of perceptual details that truth tellers have experienced during these past activities that they can recall (if they still remember them; see Chapter 7, this volume for a review of eyewitness memory). In contrast, when discussing their intentions about a forthcoming activity, truth tellers have not yet experienced anything that restricts the amount of detail in their recall of intentions.

There may be a diagnostic cue to deceit that is uniquely related to lying about intentions: the elicitation of mental images. In Granhag and Knieps's (2011) experiment, participants who told the truth about their intentions agreed more frequently that planning their future actions evoked mental images than did participants who lied about their intentions. In addition, liars who claimed to have activated a mental image during the planning phase provided verbal descriptions of it that were less rich in detail than truth tellers. Those findings are in alignment with the concept of episodic future

thought, which represents the ability to mentally pre-experience a one-time personal event that may occur in the future (Schacter & Addis, 2007). People who make up a plan for a future event that they intend to execute seem to activate a more concrete (detailed) mental image of the upcoming scenario than do those who adopt a plan that they do not intend to execute (Watanabe, 2005).

Undercover interviewing. In some investigative contexts, law enforcement and security personnel may have good reason to extract information from suspects without them actually being aware that they are under investigation. In particular, law enforcement officers working in an undercover capacity and interacting with potential suspects in informal settings will not wish to draw attention to themselves or to arouse suspicion about their motives by using direct question formats. For example, in settings where an undercover officer has become embedded within a criminal gang or is required to interact with suspects in order to collect intelligence, the ability to elicit relevant and usable information without detection is critical. In addition, in the United Kingdom the police were accused of misuse of terror laws when they stopped innocent photographers taking pictures of tourist attractions (see Jundi, Vrij, Mann, Hillman, & Hope, in press).

A possible solution in such situations is to conduct interviews without the suspect actually knowing they are being interviewed (so-called undercover interviewing). For example, an undercover interviewer could pose as a tourist pretending to take pictures of tourist attractions. Undercover interviewing may shed light on whether an individual has criminal intentions without arousing their suspicion in such circumstances. To date one undercover interviewing deception experiment has been published, and, encouragingly, that experiment demonstrated that undercover interviews can reveal deceit (Vrij, Mann, Jundi, Hope, & Leal, 2012). Liars (posing as tourists) and actual tourists were interviewed in a seemingly innocuous manner about their travel plans by an undercover investigator. Truth tellers and liars provided different responses, particularly to spatial questions (e.g., "Show me on this map the locations you just said you are going to visit?"). Liars were less accurate than truth tellers in pointing out the locations they claimed they would visit. This is an example of an effective unanticipated question: Liars do not expect spatial questions and have not prepared answers to them.

Lying by networks. Most deception research addresses individual truth tellers and liars, but terrorists often act in pairs or larger groups. For example, the London 7/7 bombers entered the Underground together, and the 9/11 bombers worked together to plan and execute the attacks. Groups of people can be interviewed in two different ways, separate or together. In the previous section, we discussed an efficient way of interviewing pairs of suspects separately by asking them unanticipated questions. Liars who have not prepared answers to those questions are more likely to show less overlap in their responses than truth tellers who can search their memory for the answers.

When people travel together, or in other situations when they are together, it may be convenient to interview them together. Recent research has shown that this method results in diagnostic cues to deceit. In one experiment, pairs of truth tellers were interviewed together about a visit to a restaurant. The liars did not visit the restaurant but had to pretend that they did visit the restaurant together. They were given time to prepare themselves for the interview. Memory research has shown that when pairs of truth tellers recall a jointly experienced event during an interview, they communicate substantially with each other in an attempt to collectively recall all the details they know, and to correct each other's stories. In this respect, Hollingshead (1998) refers to transaction information search. Consistent with this view, pairs of truth tellers interrupted and corrected each other more, and added more information to each other's stories than liars (Vrij, Jundi, et al., 2012). Two other experiments also found support for the idea that truth tellers communicate more with each other. Jundi et al. (2013) found that pairs of truth tellers looked more at each other and less at the interviewer than pairs of liars; and Driskell et al. (2012) found that pairs of truth tellers made more speech transitions than pairs of liars

(one person's speech immediately follows the other's within the flow of the conversation).

PRACTICE AND POLICY ISSUES

In this section the implications of the research review in terms of application of the various lie-detection techniques are briefly summarized. This section further contains two final thoughts. One addresses the idea whether cognitive lie detection strategies are not "too lenient" on suspects to obtain useful results. The second addresses the urge to establish clear decision rules in lie-detection tools.

Nonverbal Lie Detection

There is no evidence that guilty and innocent suspects respond to the BAI questions in the way BAI investigators believe they do. Regarding observing facial expressions of emotions, microexpressions hardly occur, and there is no empirical evidence available to date showing that they distinguish truth tellers from liars. Although facial expressions of emotions do differentiate truth tellers from liars, observing such expressions will lead to a considerably lower accuracy rate (60%–70% in high-stakes situations, lower in other situations) than the 95% claimed by Paul Ekman. The findings that truth tellers can also show signs of nervousness and that no questions can be asked that makes liars necessarily more nervous than truth tellers makes the use of anxiety-based lie nonverbal detection techniques problematic.

Verbal Lie Detection

SVA is the only tool among the verbal and nonverbal veracity tools that is used as evidence in criminal courts. Research into CBCA, the key part of SVA, has revealed an error rate of 29%. This implies that CBCA assessments are not made "beyond reasonable doubt," which is the standard of proof typically set in criminal courts. In other words, the research accumulated to date does not justify the use of CBCA/SVA as evidence in criminal courts. CBCA assessments do result in approximately 71% accuracy in classifying truth tellers and liars, however, which makes CBCA a useful tool to apply in investigative interviewing situations—considerably more useful than SCAN, which failed to accumulate any empirical support to date.

Interviewing to Detect Deception

Research during the last 10 years has indicated that investigators can improve their ability to detect deceit by applying specific questioning techniques. The three approaches reported in the interviewing to detect deception section, imposing cognitive load, asking unanticipated questions and the strategic use of evidence, have in common that they are based on the assumption that interviewers can use techniques that liars find more difficult to address than truth tellers. This cognitive lie detection approach is now the dominant approach in lie detection research (Evans, Houston, & Meissner, 2012; Kassin, 2012; Lane & Vieira, 2012; Vrij & Granhag, 2012a, 2012b), and practitioners are encouraged to use it by both scholars (Kassin, 2012) and practitioners (Tedeschini, 2012).

Lie Detection in Intelligence Interviewing

Lie detection in intelligence interviewing differs in certain aspects from lie detection in police interviewing, the more traditional forensic context. There are some unique challenges for lie detection in intelligence interviews, and three of them have been discussed: lying about intentions, and undercover and collective interviewing. Research has commenced in all these areas with some promising results, but more research is needed.

Are Cognitive Lie Detection Approaches Too Lenient?

The stereotypical view, often addressed in police manuals, is that suspects are reluctant to talk and that the investigator needs to use an accusatory approach to get them to talk. This approach is characterized by accusation, the use of minimization and maximization techniques, and the disallowing of denials (Inbau et al., 2013). The view that such techniques are needed is not shared by all practitioners in the field. Ali Soufan (2011), a successful U.S. Federal Bureau of Investigation interrogator who gathered a substantial amount of valuable information when interrogating al-Qaeda terrorists, did not use an accusatory approach. Instead he used

a cognitive, information-gathering approach characterized by rapport building, truth seeking, and listening. For example, he noticed that spatial questions are difficult to address by liars, a finding that also emerged from experimental laboratory research discussed above. The question of whether accusatory techniques are needed to obtain valuable results can be answered better via research than via anecdotal evidence. Such research has shown that the idea that suspects in police interviews are unwilling to talk in information-gathering interviews is a myth rather than fact. A systematic analysis of more than 1067 such police interviews in the United Kingdom has shown that only 5% of the suspects remained silent (Moston, Stephenson, & Williamson, 1993). In addition, in his analysis of 600 information-gathering police interviews, Baldwin (1993) found that 80% of the suspects were thoroughly cooperative and answered police questions of significance.

Furthermore, a recent meta-analysis of field and laboratory studies about the influence of the interview/interrogation method on confession outcomes revealed that cognitive information-gathering approaches elicited more diagnostic cues to deception and more diagnostic information in general than accusatorial methods (Meissner, Redlich, Bhatt, & Brandon, 2012). In summary, research findings do not support the idea that accusatory techniques are needed to yield success in interviews. On the contrary, cognitive information-gathering styles yield better results in terms of obtaining information and eliciting cues to deceit.

Clear Decision Rules in Lie-Detection Tools

For a lie-detection technique to be useful in the field, it is desirable that it includes a clear decision rule indicating when someone is truthful or deceptive. Such scores are often not available. Take for example CBCA: The CBCA rater will calculate a final CBCA score with the assumption that the higher the score the more likely it is that the person is telling the truth. There is no decision rule, however, that informs the investigator which scores indicate truth and which indicate lie. This is due to the fact that CBCA scores are influenced by factors other than veracity, such as the quality of the interview style. The BAI shares this problem and also has no clear decision rule. In contrast, the SUE technique has a decision rule (contradicting the evidence means deception), which makes the technique easier to use. Other ways of creating decision rules is to break the interview into two parts and compare the responses of the interviewee to those two parts. As discussed above, interviewees can be asked a mixture of anticipated and unanticipated questions. Liars have in all likelihood prepared answers to the anticipated questions but will not have prepared answers to the unanticipated questions. They are likely to be more detailed in answering the anticipated questions than the unanticipated questions. In contrast, truth tellers can search their memory for both sets of questions and are likely to be able to answer the two sets of questions in the same amount of detail.

SUMMARY AND CONCLUSIONS

In an attempt to catch liars, nonverbal and verbal lie-detection tools have been developed and are used in the field. Research has demonstrated that some of these tools, and CBCA in particular, can distinguish truth tellers and liars above chance. Research has yet to show that other tools, and SCAN and BAI in particular, actually work. In recent years a shift took place in nonverbal and verbal lie detection research, with a strong emphasis on cognitive-based interview protocols. Research has shown that such interview protocols can improve an investigator's ability to detect deceit. A new domain of research examines deception in intelligence interviews, which differs in several aspects from traditional police interviews and therefore requires new deception detection techniques. The emerging literature showed promising results for the ability to detect lies in this important area.

References

Armistead, T. W. (2011). Detecting deception in written statements: The British Home Office study of scientific content analysis (SCAN). *Policing*, *34*, 588–605. doi:10.1108/13639511111180225

Arntzen, F. (1982). Die Situation der Forensischen Aussagenpsychologie in der Bundesrepublik

Deutschland. In A. Trankell (Ed.), *Reconstructing the past: The role of psychologists in criminal trials* (pp. 107–120). Deventer, the Netherlands: Kluwer.

Baldwin, J. (1993). Police interview techniques. *British Journal of Criminology*, *33*, 325–352.

Bockstaele, M. (2008). Scientific Content Analysis (SCAN). Een nutting instrument by verhoren? In L. Smets & A. Vrij (Eds.), *Het analyseren van de geloofwaardigheid van verhoren* (pp. 105–156). Brussels, Belgium: Politeia.

Bond, C. F., & Fahey, W. E. (1987). False suspicion and the misperception of deceit. *British Journal of Social Psychology*, *26*, 41–46. doi:10.1111/j.2044-8309.1987.tb00759.x

Brandon, S. E. (2011). Impacts of psychological science on national security agencies post-9/11. *American Psychologist*, *66*, 495–506. doi:10.1037/a0024818

Buck, J. A., Warren, A. R., Betman, S., & Brigham, J. C. (2002). Age differences in Criteria-Based Content Analysis scores in typical child sexual abuse interviews. *Journal of Applied Developmental Psychology*, *23*, 267–283. doi:10.1016/S0193-3973(02)00107-7

Buckley, J. P. (2012). Detecting of deception researchers need to collaborate with experienced practitioners. *Journal of Applied Research in Memory and Cognition*, *1*, 126–127. doi:10.1016/j.jarmac.2012.04.002

Bull, R. (2010). The investigative interviewing of children and other vulnerable witnesses: Psychological research and working/professional practice. *Legal and Criminological Psychology*, *15*, 5–23. doi:10.1348/014466509X440160

Christ, S. E., van Essen, D. C. Watson, J. M., Brubaker, L. E., & McDermott, K. B. (2009). The contributions of prefrontal cortex and executive control to deception: Evidence from activation likelihood estimate meta-analyses. *Cerebral Cortex*, *19*, 1557–1566. doi:10.1093/cercor/bhn189

Cooke, N. J., & Winner, J. L. (2008). Human factors of homeland security. In D. A. Boehm-Davis (Ed.), *Reviews of human factors and ergonomics* (Vol. *3*, pp. 79–110). Santa Monica, CA: Human Factors and Ergonomics Society.

Dalton, A. L., & Daneman, M. (2006). Social suggestibility to central and peripheral misinformation. *Memory*, *14*, 486–501. doi:10.1080/09658210500495073

DePaulo, B. M., Lindsay, J. L., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to deception. *Psychological Bulletin*, *129*, 74–118. doi:10.1037/0033-2909.129.1.74

Driscoll, L. N. (1994). A validity assessment of written statements from suspects in criminal investigations using the SCAN technique. *Police Studies*, *17*, 77–88.

Driskell, J. E., Salas, E., & Driskell, T. (2012). Social indicators of deception. *Human Factors*, *54*, 577–588.

Ekman, P. (2001). *Telling lies: Clues to deceit in the marketplace, politics, and marriage*. New York, NY: Norton. (Original work published 1985)

Ekman, P. (2006, October 29). How to spot a terrorist on the fly. *Washington Post*. Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2006/10/27/AR2006102701478_2.html

Evans, J. R., Houston, K. A., & Meissner, C. A. (2012). A positive collaborative, and theoretically-based approach to improving deception detection. *Journal of Applied Research in Memory and Cognition*, *1*, 122–123. doi:10.1016/j.jarmac.2012.04.007

Fisher, R. P. (2010). Interviewing cooperative witnesses. *Legal and Criminological Psychology*, *15*, 25–38. doi:10.1348/135532509X441891

Gamer, M. (2011). Detection of deception and concealed information using neuroimaging techniques. In B. Verschuere, G. Ben-Shakhar, & E. Meijer (Eds.), *Memory detection: Theory and application of the concealed information test* (pp. 90–113). Cambridge, England: Cambridge University Press. doi:10.1017/CBO9780511975196.006

Granhag, P. A. (2010). On the psycho-legal study of true and false intentions: Dangerous waters and some stepping stones. *Open Criminology Journal*, *3*, 37–43. doi:10.2174/1874917801003020037

Granhag, P. A., & Hartwig, M. (2008). A new theoretical perspective on deception detection: On the psychology of instrumental mind-reading. *Psychology, Crime & Law*, *14*, 189–200. doi:10.1080/10683160701645181

Granhag, P. A., & Knieps, M. (2011). Episodic future thought: Illuminating the trademarks of forming true and false intentions. *Applied Cognitive Psychology*, *25*, 274–280. doi:10.1002/acp.1674

Granhag, P. A., Strömwall, L. A., Willén, R., & Hartwig, M. (2013). Eliciting cues to deception by tactical disclosure of evidence: The first test of the Evidence Framing Matrix. *Legal and Criminological Psychology*, *18*, 341–355. doi:10.1111/j.2044-8333.2012.02047.x

Gumpert, C. H., & Lindblad, F. (2000). Expert testimony on child sexual abuse: A qualitative study of the Swedish approach to statement analysis. *Expert Evidence*, *7*, 279–314. doi:10.1023/A:1016657130623

Hartwig, M., Granhag, P. A., & Strömwall, L. (2007). Guilty and innocent suspects' strategies during interrogations. *Psychology, Crime & Law*, *13*, 213–227. doi:10.1080/10683160600750264

Hartwig, M., Granhag, P. A., Strömwall, L., & Kronkvist, O. (2006). Strategic use of evidence during police interrogations: When training to detect deception works. *Law and Human Behavior*, *30*, 603–619. doi:10.1007/s10979-006-9053-9

Henig, R. M. (2006, February 5). Looking for the lie. *New York Times Magazine*. Retrieved from http://www.nytimes.com/2006/02/05/magazine/05lying.html

Hershkowitz, I., Lamb, M. E., Sternberg, K. J., & Esplin, P. W. (1997). The relationships among interviewer utterance type, CBCA scores and the richness of children's responses. *Legal and Criminological Psychology*, *2*, 169–176. doi:10.1111/j.2044-8333.1997.tb00341.x

Hocking, J. E., & Leathers, D. G. (1980). Nonverbal indicators of deception: A new theoretical perspective. *Communication Monographs*, *47*, 119–131. doi:10.1080/03637758009376025

Hollingshead, A. B. (1998). Retrieval processes in transactive memory systems. *Journal of Personality and Social Psychology*, *74*, 659–671. doi:10.1037/0022-3514.74.3.659

Horvath, F. (1973). Verbal and nonverbal cues to truth and deception during polygraph examinations. *Journal of Police Science and Administration*, *1*, 138–152.

Horvath, F., Blair, J. P., & Buckley, J. P. (2008). The behavioral analysis interview: Clarifying the practice, theory and understanding of its use and effectiveness. *International Journal of Police Science and Management*, *10*, 101–118. doi:10.1350/ijps.2008.10.1.101

Horvath, F., Jayne, B., & Buckley, J. (1994). Differentiation of truthful and deceptive criminal suspects in behavioral analysis interviews. *Journal of Forensic Sciences*, *39*, 793–807.

Iacono, W. G. (2008). Accuracy of polygraph techniques: Problems using confessions to determine ground truth. *Physiology and Behavior*, *95*, 24–26. doi:10.1016/j.physbeh.2008.06.001

Iacono, W. G., & Lykken, D. T. (1997). The validity of the lie detector: Two surveys of scientific opinion. *Journal of Applied Psychology*, *82*, 426–433. doi:10.1037/0021-9010.82.3.426

Inbau, F. E., Reid, J. E., Buckley, J. P., & Jayne, B. C. (2013). *Criminal interrogation and confessions* (5th ed.). Burlington, MA: Jones & Bartlett Learning.

Jundi, S., Vrij, A., Mann, S., Hillman, J., & Hope, L. (in press). "I'm a photographer, not a terrorist": The use of photography to detect deception. *Psychology, Crime & Law*.

Jundi, S., Vrij, A., Mann, S., Hope, L., Hillman, J., Warmelink, L., & Gahr, E. (2013). Who should I look at? Eye contact during collective interviewing as a cue to deceit. *Psychology, Crime & Law*, *19*, 661–771. doi:10.1080/1068316X.2013.793332

Kassin, S. M. (2012). Paradigm shift in the study of human lie-detection: Bridging the gap between science and practice. *Journal of Applied Research in Memory and Cognition*, *1*, 118–119. doi:10.1016/j.jarmac.2012.04.009

Kassin, S. M., & Fong, C. T. (1999). "I'm innocent!": Effects of training on judgments of truth and deception in the interrogation room. *Law and Human Behavior*, *23*, 499–516. doi:10.1023/A:1022330011811

Kleiner, M. (2002). *Handbook of polygraph testing*. San Diego, CA: Academic Press.

Köhnken, G. (1996). Social psychology and the law. In G. R. Semin & K. Fiedler (Eds.), *Applied social psychology* (pp. 257–281). London, Great Britain: Sage Publications. doi:10.4135/9781446250556.n10

Köhnken, G. (2004). Statement validity analysis and the detection of the truth. In P. A. Granhag & L. A. Strömwall (Eds.), *Deception detection in forensic contexts* (pp. 41–63). Cambridge, England: Cambridge University Press. doi:10.1017/CBO9780511490071.003

Köhnken, G., & Steller, M. (1988). The evaluation of the credibility of child witness statements in German procedural system. In G. Davies & J. Drinkwater (Eds.), *The child witness: Do the courts abuse children?* (Issues in Criminological and Legal Psychology, No. 13; pp. 37–45). Leicester, United Kingdom: British Psychological Society.

Lamers-Winkelman, F., & Buffing, F. (1996). Children's testimony in the Netherlands: A study of Statement Validity Analysis. In B. L. Bottoms & G. S. Goodman (Eds.), *International perspectives on child abuse and children's testimony* (pp. 45–61). Thousand Oaks, CA: Sage Publications. doi:10.4135/9781483327501.n3

Lane, S. M., & Vieira, K. M. (2012). Steering a new course for deception detection research. *Journal of Applied Research in Memory and Cognition*, *1*, 136–138. doi:10.1016/j.jarmac.2012.04.001

Leal, S., Vrij, A., Mann, S., & Fisher, R. (2010). Detecting true and false opinions: The devil's advocate approach as a lie detection aid. *Acta Psychologica*, *134*, 323–329. doi:10.1016/j.actpsy.2010.03.005

Loftus, E. F. (2011). Intelligence gathering post-9/11. *American Psychologist*, *66*, 532–541. doi:10.1037/a0024614

Mann, S., Vrij, A., & Bull, R. (2004). Detecting true lies: Police officers' ability to detect deceit. *Journal of Applied Psychology*, *89*, 137–149. doi:10.1037/0021-9010.89.1.137

Mann, S., Vrij, A., Shaw, D. J., Leal, S., Ewans, S., Hillman, J., . . . Fisher, R. P. (2013). Two heads are better than one? How to effectively use two interviewers to elicit cues to deception. *Legal and Criminological Psychology*, *18*, 324–340. doi:10.1111/j.2044-8333.2012.02055.x

Masip, J., Barba, A., & Herrero, C. (2012). Behaviour analysis interview and common sense. A study with novice and experienced officers. *Psychiatry, Psychology and Law*, *19*, 21–34. doi:10.1080/13218719.2010.543402

Masip, J., & Herrero, C. (2013). What would you say if you were guilty? Suspects' strategies during a hypothetical behavior analysis interview concerning a serious crime. *Applied Cognitive Psychology*, *27*, 60–70. doi:10.1002/acp.2872

Masip, J., Herrero, C., Garrido, E., & Barba, A. (2011). Is the behaviour analysis interview just common sense? *Applied Cognitive Psychology*, *25*, 593–604. doi:10.1002/acp.1728

Masip, J., Sporer, S., Garrido, E., & Herrero, C. (2005). The detection of deception with the reality monitoring approach: A review of the empirical evidence. *Psychology, Crime & Law*, *11*, 99–122. doi:10.1080/10683160410001726356

Meissner, C. A., Redlich, A. D., Bhatt, S., & Brandon, S. (2012). Interview and interrogation methods and their effects on true and false confessions. *Campbell Systematic Reviews*, *8*(13). doi:10.4073/csr.2012.13

Memon, A., Meissner, C. A., & Fraser, J. (2010). The cognitive interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law*, *16*, 340–372. doi:10.1037/a0020518

Moston, S. J., Stephenson, G. M., & Williamson, T. M. (1993). The incidence, antecedents and consequences of the use of the right to silence during police questioning. *Criminal Behaviour and Mental Health*, *3*, 30–47.

Nahari, G., Vrij, A., & Fisher, R. P. (2012). Does the truth come out in the writing? SCAN as a lie detection tool. *Law and Human Behavior*, *36*, 68–76. doi:10.1037/h0093965

National Research Council. (2003). The polygraph and lie detection. *Committee to Review the Scientific Evidence on the Polygraph*. Washington, DC: The National Academic Press.

Obituary: Toulouse gunman Mohamed Merah. (2012, March 22). *BBC World News*. Retrieved from http://www.bbc.com/news/world-europe-17456541

Ofshe, R. J., & Leo, R. A. (1997). The decision to confess falsely: Rational choice and irrational action. *Denver University Law Review*, *74*, 979–1112.

Porter, S., & ten Brinke, L. (2008). Reading between the lies: Identifying concealed and falsified emotions in universal facial expressions. *Psychological Science*, *19*, 508–514. doi:10.1111/j.1467-9280.2008.02116.x

Porter, S., & Yuille, J. C. (1996). The language of deceit: An investigation of the verbal clues to deception in the interrogation context. *Law and Human Behavior*, *20*, 443–458. doi:10.1007/BF01498980

Reid, J. E., & Arther, R. O. (1953). Behavior symptoms of lie-detector subjects. *Journal of Criminal Law, Criminology, and Police Science*, *44*, 104–108. doi:10.2307/1139477

Rosenfeld, J. P. (2011). P300 in detecting concealed information. In B. Verschuere, G. Ben-Shakhar, & E. Meijer (Eds.), *Memory detection: Theory and application of the concealed information test* (pp. 63–89). Cambridge, England: Cambridge University Press.

Ruby, C. L., & Brigham, J. C. (1997). The usefulness of the criteria-based content analysis technique in distinguishing between truthful and fabricated allegations. *Psychology, Public Policy, and Law*, *3*, 705–737. doi:10.1037/1076-8971.3.4.705

Ruby, C. L., & Brigham, J. C. (1998). Can criteria-based content analysis distinguish between true and false statements of African-American speakers? *Law and Human Behavior*, *22*, 369–388. doi:10.1023/A:1025766825429

Sapir, A. (2000). *The LSI course on scientific content analysis (SCAN)*. Phoenix, AZ: Laboratory for Scientific Interrogation. (Original work published 1987)

Schacter, D. L., & Addis, D. R. (2007). The cognitive neuroscience of constructive memory: Remembering the past and imagining the future. *Philosophical Transactions of the Royal Society*, *392*, 773–786. doi:10.1098/rstb.2007.2087

Smith, N. (2001). *Reading between the lines: An evaluation of the scientific content analysis technique (SCAN)*. London, England: Research, Development and Statistics Directorate, Home Office.

Soufan, A. H. (2011). *The black banners: The inside story of 9/11 and the war against al-Qaeda*. New York, NY: Norton.

Steller, M., & Köhnken, G. (1989). Criteria-based content analysis. In D. C. Raskin (Ed.), *Psychological methods in criminal investigation and evidence* (pp. 217–245). New York, NY: Springer-Verlag.

Tedeschini, J. (2012). Overcoming roadblocks to reform. *Journal of Applied Research in Memory and Cognition*, *1*, 134–135. doi:10.1016/j.jarmac.2012.04.008

ten Brinke, L., MacDonald, S., Porter, S., & O'Connor, B. (2012). Crocodile tears: Facial, verbal and body language behaviours associated with genuine and fabricated remorse. *Law and Human Behavior*, *36*, 51–59. doi:10.1037/h0093950

ten Brinke, L., & Porter, S. (2012). Cry me a river: Identifying the behavioural consequences of extremely high-stakes interpersonal deception. *Law and Human Behavior*, *36*, 469–477. doi:10.1037/h0093929

ten Brinke, L., Porter, S., & Baker, A. (2012). Darwin the detective: Observable facial muscle contractions reveal emotional high-stakes lies. *Evolution and Human Behavior*, *33*, 411–416. doi:10.1016/j.evolhumbehav.2011.12.003

Trankell, A. (1972). *Reliability of evidence*. Stockholm, Sweden: Beckmans.

Trovillo, P. V. (1939). A history of lie detection, I. *Journal of Criminal Law and Criminology*, *29*, 848–881. doi:10.2307/1136489

Undeutsch, U. (1982). Statement reality analysis. In A. Trankell (Ed.), *Reconstructing the past: The role of psychologists in criminal trials* (pp. 27–56). Deventer, the Netherlands: Kluwer.

Undeutsch, U. (1989). The development of statement reality analysis. In J. C. Yuille (Ed.), *Credibility assessment* (pp. 101–119). Dordrecht, the Netherlands: Kluwer. doi:10.1007/978-94-015-7856-1_6

Verschuere, B., Ben-Shakhar, G., & Meijer, E. (Eds.). (2011). *Memory detection: Theory and application of the concealed information test*. Cambridge, England: Cambridge University Press. doi:10.1017/CBO9780511975196

Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities* (2nd ed.). Chichester, England: Wiley.

Vrij, A., Fisher, R., Mann, S., & Leal, S. (2006). Detecting deception by manipulating cognitive load. *Trends in Cognitive Sciences*, *10*, 141–142. doi:10.1016/j.tics.2006.02.003

Vrij, A., & Granhag, P. A. (2012a). Eliciting cues to deception and truth: What matters are the questions asked. *Journal of Applied Research in Memory and Cognition*, *1*, 110–117. doi:10.1016/j.jarmac.2012.02.004

Vrij, A., & Granhag, P. A. (2012b). The sound of critics: New tunes, old tunes and resistance to play. *Journal of Applied Research in Memory and Cognition*, *1*, 139–143. doi:10.1016/j.jarmac.2012.05.001

Vrij, A., Granhag, P. A., Mann, S., & Leal, S. (2011). Outsmarting the liars: Towards a cognitive lie detection approach. *Current Directions in Psychological Science*, *20*, 28–32. doi:10.1177/0963721410391245

Vrij, A., Granhag, P. A., & Porter, S. B. (2010). Pitfalls and opportunities in nonverbal and verbal lie detection. *Psychological Science in the Public Interest*, *11*, 89–121. doi:10.1177/1529100610390861

Vrij, A., Jundi, S., Hope, L., Hillman, J., Gahr, E., Leal, S., . . . Granhag, P. A. (2012). Collective interviewing of suspects. *Journal of Applied Research in Memory and Cognition*, *1*, 41–44. doi:10.1016/j.jarmac.2011.12.002

Vrij, A., Leal, S., Granhag, P. A., Mann, S., Fisher, R. P., Hillman, J., & Sperry, K. (2009). Outsmarting the liars: The benefit of asking unanticipated questions. *Law and Human Behavior*, *33*, 159–166. doi:10.1007/s10979-008-9143-y

Vrij, A., Leal, S., Mann, S., & Granhag, P. A. (2011). A comparison between lying about intentions and past activities: Verbal cues and detection accuracy. *Applied Cognitive Psychology*, *25*, 212–218. doi:10.1002/acp.1665

Vrij, A., Mann, S., & Fisher, R. (2006). An empirical test of the behaviour analysis interview. *Law and Human Behavior*, *30*, 329–345. doi:10.1007/s10979-006-9014-3

Vrij, A., Mann, S., Fisher, R., Leal, S., Milne, B., & Bull, R. (2008). Increasing cognitive load to facilitate lie detection: The benefit of recalling an event in reverse order. *Law and Human Behavior*, *32*, 253–265. doi:10.1007/s10979-007-9103-y

Vrij, A., Mann, S., Jundi, S., Hope, L., & Leal, S. (2012). Can I take your picture? Undercover interviewing to detect deception. *Psychology, Public Policy, and Law*, *18*, 231–244. doi:10.1037/a0025670

Vrij, A., Mann, S., Leal, S., & Fisher, R. (2010). "Look into my eyes": Can an instruction to maintain eye contact facilitate lie detection? *Psychology, Crime & Law*, *16*, 327–348. doi:10.1080/10683160902740633

Vrij, A., & Verschuere, B. (2013). Lie detection in a forensic context. *Oxford Bibliographies Online: Psychology*. doi:10.1093/abo/9780199828340-0122

Warmelink, L., Vrij, A., Mann, S., Jundi, S., & Granhag, P. A. (2012). Have you been there before? The effect of experience and question expectedness on lying about intentions. *Acta Psychologica*, *141*, 178–183.

Watanabe, H. (2005). Semantic and episodic predictions of memory for plans. *Japanese Psychological Research*, *47*, 40–45. doi:10.1111/j.1468-5584.2005.00271.x

Willsher, K. (2012, March 25). Failure to find first chosen target led assassin to a Jewish school. *Observer*, pp. 24–25.

Yuille, J. C. (1988). The systematic assessment of children's testimony. *Canadian Psychology*, *29*, 247–262. doi:10.1037/h0079769

Zuckerman, M., DePaulo, B. M., & Rosenthal, R. (1981). Verbal and nonverbal communication of deception. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 14, pp. 1–57). New York, NY: Academic Press.