



Which Lie Detection Tools are Ready for Use in the Criminal Justice System?☆



Aldert Vrij*

University of Portsmouth, UK

Ronald P. Fisher

Florida International University, United States

We introduce ‘arousal based’ lie detection tools (the Behavior Analysis Interview, the Comparison Question polygraph Test, CQT) and ‘cognition based’ lie detection tools (imposing cognitive load, encouraging interviewees to say more, asking unexpected questions, Strategic Use of Evidence, Verifiability Approach and Concealed Information polygraph Test, CIT), and discuss whether they are ready for use in investigative interviews. We developed ten criteria on which to judge their suitability. The two arousal-based techniques (frequently used) fall short on numerous criteria. There are too many problems associated with the imposing cognitive load technique, but the other cognitive techniques are ready for use (encouraging interviewees to say more and Strategic Use of Evidence) or ready for use if they continue to receive support in empirical research (asking unexpected questions and Verifiability Approach). The CIT polygraph test cannot be included in a standard investigative interview but can be useful in addition to investigative interviewing.

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Research on lie detection has produced a shift in focus over the last years, away from measures frequently used in criminal investigations that seek to detect lies by monitoring anxiety or arousal (e.g., the Behavior Analysis Interview), the Comparison Question [polygraph] Test, CQT) and toward innovative measures that emphasize truth tellers’ and liars’ cognitively different psychological states (Vrij & Granhag, 2012). Such techniques take into account (a) that lying in interviews is often mentally more taxing than truth telling (e.g., imposing cognitive load), and (b) the different strategies truth tellers and liars use during

interrogations (encouraging interviewees to say more, Strategic Use of Evidence and Verifiability Approach) and exploit the facts that (c) liars prepare themselves for interviews (e.g., asking unexpected questions), and (d) people orient toward familiar information (Concealed Information polygraph Test, CIT).

We briefly describe the techniques followed by a discussion whether they are ready for use in the criminal justice system, particularly in investigative interviews. For this purpose we developed ten criteria on which to judge their suitability and

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* Correspondence concerning this article should be addressed to Aldert Vrij, University of Portsmouth, Psychology Department, King Henry

Building, King Henry 1 Street, PO1 2DY Portsmouth, Hants, UK. Contact: aldert.vrij@port.ac.uk

discuss the extent to which each of these tests fits each of these criteria.¹

Arousal-Based Lie Detection Tools

Behavior Analysis Interview (BAI)

The BAI consists of a set of standardized questions and is an integral part of the Reid Interrogation Technique. It is used to determine whether a suspect is likely to be guilty such that only suspects thought to be guilty will be submitted to the Reid Nine Steps of Interrogation. It is assumed that during the BAI liars feel more uncomfortable than truth tellers and display more nervous behaviors (e.g., crossing legs, shifting about in chairs, performing grooming behaviors, or looking away from the investigator) (Inbau, Reid, Buckley, & Jayne, 2013).

Comparison Question Test (CQT)

During a CQT examinees are attached to the polygraph and are asked relevant questions, e.g., ‘Did you murder Joe Frisbie on March 12, 2016?’ and comparison questions, e.g., ‘Before 2015, did you ever physically injure someone who loved and trusted you?’ Comparison questions are designed to provide the innocent suspect with an opportunity to become more concerned with the comparison questions than with the relevant questions. Examinees who react most strongly to the comparison questions are considered truthful and examinees who react most strongly to the relevant questions are considered deceptive (Raskin & Honts, 2002).

Cognitive-Based Lie Detection Tools

Imposing Cognitive Load

Lying in interview settings is typically more mentally taxing than truth telling (see fMRI research, e.g., Christ, Van Essen, Watson, Brubaker, & McDermott, 2009; Vrij & Ganis, 2014). Investigators can exploit truth tellers’ and liars’ different mental states by making the interview setting cognitively more difficult, for example by asking interviewees to engage in a concurrent, second, task when discussing the event. Liars, whose mental resources are more depleted, are less able than truth tellers

to cope with additional requests (e.g., Debey, Verschuere, & Crombez, 2012).

Asking Unexpected Questions

Liars typically prepare themselves for anticipated interviews by considering answers to questions they expect to be asked (e.g., Hartwig, Granhag, & Strömwall, 2007). The problem liars face is that they cannot know what will be asked. When investigators ask a mixture of anticipated and unanticipated questions, truth tellers answer these questions with similar ease, but liars find answering the unanticipated question more difficult than answering the anticipated questions (Lancaster, Vrij, Hope, & Waller, 2012).

Encouraging Interviewees to Say More

When prompted to expand on their original narrative, liars will provide less new information than truth tellers (Vrij, Hope, & Fisher, 2014). Liars do not add the same amount of information as truth tellers do in reaction to such prompts because they find it cognitively too difficult to add many plausible sounding details or may be reluctant to add more details out of fear that it will provide leads to investigators which can give their lies away (Leal, Vrij, Warmelink, & Fisher, 2015).

Strategic Use of Evidence (SUE)

During interviews truth tellers are generally forthcoming, whereas liars are inclined to be avoidant (e.g., in a free recall avoiding mentioning where they were at a certain time) or use denials (e.g., denying having been at a certain place at a certain time when asked directly) (Granhag & Hartwig, 2008). When investigators ask questions related to the evidence without making the interviewee aware that they possess this evidence, these different behaviors used by truth tellers and liars result in truthful suspects’ accounts being more consistent with the available evidence than deceptive suspects’ accounts (Hartwig, Granhag, & Luke, 2014).

Verifiability Approach

Liars prefer to provide many details because they are aware that accounts rich in detail are more likely to be believed. They also prefer to avoid mentioning too many details out of fear that investigators will check such details (Nahari, Vrij, & Fisher, 2012). A strategy that incorporates both goals is to provide details that cannot be verified. Liars use this strategy and typically report fewer details that can be checked than truth tellers (Nahari, Vrij, & Fisher, 2014).

Concealed Information Test (CIT)

A CIT polygraph test can be used when examinees deny knowledge of a specific crime. During the test examinees are given questions with multiple-choice answers (e.g., How did the murderer kill his victim: Did he (i) drown her; (ii) strangle her with a rope; (iii) stab her with a knife or (iv) shoot her with a gun?) A deceptive examinee will recognize the correct answer

¹ Over the years Paul Ekman has argued that facial expressions of emotion betray liars (Ekman, 1985/2001). According to Ekman, aspects of facial communication are beyond control and can betray a deceiver’s true emotion via micro-expressions (lasting 1/25 to 1/5 of a second) of that emotion. The method became known to the public through the fictional character Dr. Cal Lightman who successfully uses this method to catch liars in the American crime drama series *Lie to Me*. Ekman has claimed that his system of lie detection can be taught to anyone with an accuracy of more than 95% (*New York Times Magazine*, 5 February 2006; see also *Washington Post*, 29 October 2006 for a similar statement). However, Ekman has never published empirical data to back up this claim. That is, he has not published data showing that observers achieve this accuracy; neither has he published data showing that facial expressions of emotions are a diagnostic indicator of deceit. Regarding the latter, Porter and ten Brinke (2008) found that micro-expressions only occurred in 14 out of the 697 analyzed expressions, and that six of those 14 expressions were displayed by truth tellers. Since the analysis of micro-expressions is not an interview technique, it will not be discussed in this article.

which produces a (physiological) orienting response. A truthful suspect does not recognize the correct answer and will not show an orienting response (Ben-Shakhar & Elaad, 2002).

Criteria for the Use of Lie Detection Tools in Investigative Interviews

The ten criteria we believe are important to determine whether a lie detection tool could be used in investigative interviews are mentioned in Table 1. The table also shows how each of the eight lie detection tools satisfies each of these criteria.

The first five criteria are derived from the *Daubert* guidelines, the guidelines which need to be met for a technique to be accepted as evidence in US criminal courts. We used these guidelines because we think they are also useful for investigative interviews, although support required differs between investigative interviews and criminal courts. For example, in criminal courts a very low error rate is required, considerably lower than in investigative interviews. The hypotheses underlying the techniques can be tested (Criterion 1) and actually have been tested (Criterion 2). Peer-reviewed articles have been published about each of the techniques (Criterion 3), although the number of empirical studies testing each technique ranges from only a couple (Behavior Analysis Interview) to more than 25 studies (CQT and CIT polygraph tests). For meta-analyses of the imposing cognitive load, asking unexpected questions, encouraging interviewee to say more techniques, see Vrij, Fisher, and Blank (2016); and for a meta-analysis of the Strategic Use of Evidence technique, see Hartwig et al. (2014). For a review of the Verifiability Approach, see Vrij and Nahari (2016). If we say, arbitrarily, that a lie detection technique needs to be *supported* empirically (rather than just tested) in at least ten empirical studies to consider its support robust, we could conclude that robust support has been obtained for four techniques: CQT, encouraging interviewees to say more, Strategic Use of Evidence and CIT.

Criterion 4 refers to known error rates. These are unknown in the field. Field studies are scarce in lie detection research due to difficulties in (i) establishing ground truth (the actual veracity status of a suspect) and (ii) obtaining access to relevant real life material from investigators. Error rates in the laboratory for the Behavior Analysis Interview and Strategic Use of Evidence are unknown. Only one Behavior Analysis Interview laboratory study has been published (Vrij, Mann, Kristen, & Fisher, 2007), which is not enough to obtain a reliable error rate. In Strategic Use of Evidence research accuracy rates are typically not reported but it has consistently been demonstrated that liars' statements are less consistent with the evidence than truth tellers' statements when the Strategic Use of Evidence technique is used (Hartwig et al., 2014). For the other techniques, laboratory studies have shown error rates below 20% for the two polygraph tests (Vrij, 2008) and around 30% for the other tests (Vrij et al., 2016; Vrij & Nahari, 2016). This results in an 80% accuracy rate for the two polygraph tests and 70% accuracy for the other tests.

These error rates are too high for criminal courts. If convictions will be based on the outcome of a lie detection test, error

rates have to be very small. Veracity judgements are frequently made in investigative interviews with important consequences. They are not used as proof of anything. Instead they inform investigators about a range of decisions they make (e.g., whether or not to further invest time in interviewing a suspect or to take action based on what a suspect said in an interview). Lie detection tools with error rates around 30–35% could be useful for investigators to use when making such decisions.

Criterion 5 refers to acceptance in the scientific community of a given tool. The two arousal-based lie detection tools have attracted criticism (Iacono & Lykken, 1997; Vrij, Mann, & Fisher, 2006) as has the imposing cognitive load technique (Levine & McCornack, 2014). The CIT polygraph test has been criticized but mostly because it cannot be used in many situations (Honts, 2004). The CIT's theoretical underpinning is generally accepted by the scientific community (Iacono & Lykken, 1997). The other tools are not yet disputed in the scientific literature but they were introduced only recently.

Since none of the techniques meet all five *Daubert* criteria, they cannot be used as evidence in US criminal courts. This conclusion may be somewhat restricted. For example, outcomes of a Strategic Use of Evidence interrogation could sometimes be introduced in court. A successful Strategic Use of Evidence-based interrogation can reveal that a suspect's statement is inconsistent with the evidence and such a lie could be introduced as evidence in court. In Verifiability Approach lie detection test a suspect's bluffing can be detected. A suspect who tells the investigator that 'he was somewhere else at the time of the crime as CCTV footage at the location where he claimed to have been will show' is caught bluffing if the suspect cannot be seen on that CCTV footage. His alibi falls apart which could be mentioned in court.

Criterion 6 addresses whether a technique easily can be incorporated in a typical investigative interview. If it can, investigators are more likely to consider it to be a helpful tool; if not, investigators may become reluctant or even threatened by it. The Behavior Analysis Interview and the two polygraph tests (CQT and CIT) are 'stand alone' tests with their own interview protocols and therefore cannot be carried out as part of a standard investigative interview. All other techniques can be incorporated in a standard investigative interview. Several of them (imposing cognitive load, asking unexpected questions, encouraging interviewees to say more, verifiability approach) can be combined with each other.

Criterion 7 examines whether a technique affects a truth teller's response during a standard investigative interview. The aim of an investigative interview is to elicit from an interviewee a complete and accurate account of what s/he knows. This is difficult to achieve (Vrij et al., 2014) so it is important to consider whether a technique has the potential to block this goal. This criterion is not applicable to the techniques that cannot be included in an investigative interview (Behavior Analysis Interview, CQT and CIT polygraph tests). Some imposing cognitive load requests (e.g., carrying out a secondary task) will hamper eliciting information because the interviewees' cognitive resources are being directed to something other than searching through memory. Such requests also could make a truth teller

Table 1
Overview of the Lie Detection Tools and Their Usefulness in Investigative Interviews

	Behavior Analysis Interview (BAI)	Control/Comparison Question Test (CQT)	Imposing cognitive load	Asking unexpected questions	Encouraging interviewees to say more	Strategic Use of Evidence (SUE)	Verifiability Approach (VA)	Concealed Information Test (CIT)
1) Is the scientific hypothesis testable?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2) Has the proposition been tested?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3) Has the technique been subjected to peer review and publication?	<5	>25	5–10	5–10	10–20	10–20	5–10	>25
4) Is there a known error rate?	No	<20%	Around 30%	Around 30%	Around 30%	No	Around 30%	<20%
5) Is the theory upon which the technique is based generally accepted in the appropriate scientific community?	No	No	No	Yes	Yes	Yes	Yes	Yes
6) Is the technique easy to incorporate in a typical information-gathering interview?	No	No	Yes	Yes	Yes	Yes	Yes	No
7) Will the technique affect the response of a truthful interviewee?	NA	NA	Yes	Possibly if carried out incorrectly	No	Possibly	No	NA
8) Is the technique easy to use?	No	No	Yes, after practice	Yes, after practice	Yes	Yes, after practice	Yes	No
9) Does the technique sufficiently protect truth telling interviewees for appearing suspicious?	No	No	No	Yes	Yes	Yes	Yes	Yes
10) Is the technique sufficiently protected against countermeasures?	No	No	Yes	Yes	Yes	Yes	Yes	No
Verdict: Are the findings sufficiently robust, generalizable, and uncontroversial that they can be incorporated in investigative interviews?	No	No	No	Possibly, more research is needed	Yes	Yes	Possibly, more research is needed	No, but could be used in addition to an investigative interview

feel uncomfortable which will subsequently hamper the elicitation of information. The unanticipated questions technique could make a truth teller feel uncomfortable in case the questions are seen as odd. A Strategic Use of Evidence interview reduces the likelihood that a guilty suspect will confess immediately as no evidence is presented at the beginning of the interview to convince a guilty suspect to confess. The remaining techniques are not expected to have a negative influence on the amount and accuracy of the information truth tellers report.

Criterion 8 addresses whether the techniques are easy to use. Investigators may be less receptive to techniques that require a lot of skill, training, equipment or resources. There is considerable training required to use the stand-alone techniques (Behavior Analysis Interview, CQT and CIT polygraph tests). Investigators need to be taught which questions to ask and how to interpret the interviewees' responses. For the CQT and CIT investigators also need to be taught how to use a polygraph machine. The imposing

cognitive load, asking unanticipated questions and Strategic Use of Evidence techniques need some practice. For imposing cognitive load, skills are required to introduce an additional request that introduces cognitive load to interviewees. Some are easier to introduce than others because a better reason can be given for the request. For example, the request to report a story in reverse chronological order is relatively easy to explain to interviewees as it often results in extra information and thus a more complete recall. This reason cannot be given for asking interviewees to look the investigator into the eyes. For asking unanticipated questions and SUE, training is required about which questions to ask during the interview. The encouraging interviewees to say more, and Verifiability Approach techniques can be introduced without much training.

Criterion 9 refers to the protection against a lie bias. The errors lie detection tools generate are not random; some tools are prone to false-positive errors (judging a truth teller as a liar),

whereas other tools are prone to false-negative errors (judging a liar as a truth teller). Which error is most serious depends on the situation, but when an investigator mistakenly believe that an innocent suspect is lying (false-positive error), they often use less appropriate methods to make the suspect to admit that he or she is lying (Kassin, Goldstein, & Savitsky, 2003). The arousal-based protocols (Behavior Analysis Interview and CQT) are prone to false-positive errors as truth tellers can easily appear nervous or anxious during such tests. Truth tellers can easily struggle when cognitive load is imposed on them, which may make them look like liars. The other techniques protect truth tellers sufficiently well against being seen as liars.

Criterion 10 addresses whether the techniques can be counteracted by suspects through training or planning. The questions asked in a Behavior Analysis Interview are published in the literature as are the typical responses given by truth tellers and liars (Inbau et al., 2013). Suspects may therefore be able to counteract this technique. Research has shown that the CQT and CIT polygraph tests can be successfully counteracted by examinees who know the working of the tests (Vrij, 2008). The other techniques can be less easily counteracted. The unanticipated questions technique is difficult to counteract because of the surprise element of the questions that will be asked, the Strategic Use of Evidence technique because suspects cannot know what evidence the investigator has against them, and the Verifiability Approach because liars typically cannot provide verifiable detail. The difficulty liars face in counteracting the imposing cognitive load, and encouraging interviewees to say more techniques is to look like truth tellers. That is, truth tellers should find it easier to cope with the additional imposing cognitive load requests; and truth tellers can typically provide more details than liars because liars are restricted by the fact that the more information they volunteer, the more leads they provide to investigators which can give away that they are lying.

Which Lie Detection Tools Ready for Real-World Use in the Criminal Justice System: Final Verdict

There is substantial difference in the extent to which the eight lie detection techniques met the criteria we think should be met to make them ready for real world use in investigative interviews (see Table 1). The two arousal-based techniques fall short on numerous criteria although they are currently used frequently. Of the cognitive approaches, there are too many problems associated with the imposing cognitive load technique to recommend it for use in real life, but other techniques are ready for use (encouraging interviewees to say more and Strategic Use of Evidence) or ready for use if they continue to receive support in empirical research (asking unexpected questions and Verifiability Approach). The CIT polygraph test cannot be included in a standard investigative interview but can be a useful tool in addition to investigative interviewing.

Author Contributions

Vrij wrote the first draft of the article, Fisher commented on it, and Vrij revised the article based on Fisher's comments. Vrij was also responsible for addressing the reviewers' comments.

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