Detecting Deception: The Benefit of Looking at a Combination of Behavioral, Auditory and Speech Content Related Cues in a Systematic Manner

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Abstract

People communicate with each other across distance in a variety of ways, for example, via the telephone, via electronic forms of communication (the written word) or via videolinks. In this article, behavioral, auditory and speech content related cues which research has shown discriminate (to some extent) between liars and truth tellers will be discussed. Although research has indicated that people are generally poor at detecting deceit, some recent studies suggest that looking at nonverbal, auditory and speech content related responses in an objective and systematic manner will lead to more accurate classifications of liars and truth tellers. These studies will be discussed. Apart from examining the available cues objectively and systematically, lie detection might further improve if the lie detector employs certain communication techniques. In the final part of this article we will discuss some of these techniques.

People communicate with each other in a variety of ways, for example, face to face, via the telephone, via electronic forms of communication (the written word) or via videolinks. In theory, lie detection might be possible in each communication form as long as a person's behavior, voice or speech content contains signs of deceit. In this article, behavioral cues (i.e. body related cues, such as gaze behavior, smiles, and movements), auditory cues (i.e. vocal cues such as pitch of voice, speech rate, and speech disturbances) and speech content related cues (i.e. verbal criteria such as the amount of details mentioned) which might be worth examining in order to detect deceit, will be presented.

People can detect lies (we will use the words 'lying' and 'deception' interchangeably throughout this article) on the basis of these cues in different ways. Lie detection can be conducted in an objective and systematic manner. That is, the frequency of occurrence of the available cues are calculated and truth/lie decisions are made on the basis of the frequency of occurrence of these cues using multiple cue decision models which are based upon our current knowledge of cues to deceit. However, this is not the way that lie detection typically occurs. In most daily life situations, lie detection takes place in a more subjective and unsystematic manner. That is, instead of calculating the frequency of occurrence of the available cues, people form global impressions of the frequency of occurrence of the available cues. Instead of using clearly defined multiple cue decision models, their impression of the available information is then translated into truth/lie decisions in a more subjective and less systematic way, using private decision models which sometimes take invalid cues to deception into account. When people detect deceit in the latter, more sub-

jective and more unsystematic manner, hit rates (percentage of correct answers) are typi-cally low. They usually vary between 45 and 60%, when a 50% hit rate would be obtained by tossing a coin (DePaulo, Stone, and Lassiter 1985; Kraut 1980; Vrij 2000). In this arti-cle, however, we will provide evidence that higher hit rates could be achieved by employ-ing an objective and systematic lie detection method.

Lie telling and detection often occurs in situations in which interviewer and interviewee interact with each other. We believe that, apart from using more objective lie detection decision models, lie detection might be further facilitated when the lie detector employs certain communication techniques. A few such techniques will also be discussed.

Theoretical reasons for cues to deceit

Four decades of deception research in which more than 100 studies have been published have revealed one major finding. The mere fact that someone lies will not affect his behavior, voice or speech, and therefore typical deceptive responses such as 'Pinocchio's growing nose' do not exist (DePaulo, Lindsay, Malone, Muhlenbruck, Charlton, and Cooper 2003; Vrij 2000).

However, some responses are more likely to occur during deception than others, because liars may experience three different processes during deception, called '*emotional*', '*content complexity*' and '*attempted behavioral control (impression management)*' processes, and each of these processes may influence someone's response (Vrij 2000).[1] In other words, a liar's behavior, voice or speech might be affected, not because the person lies, but be-cause, for example, s/he experiences certain emotions when s/he is lying. Each process em-phasizes a different aspect of deception and deceptive responses. However, the distinction between them is artificial. Lies may well feature all three aspects, and the three processes should not be considered as opposing camps.

Three processes

Telling a lie might evoke three different emotions: Fear, guilt or duping delight (Ekman 1985/2001). A liar might feel *guilty* because (s)he is lying, might be *afraid* of getting caught, or might be *excited* about having the opportunity to fool someone. The strength of these emotions depends on the personality of the liar and on the circumstances under which the lie takes place (Ekman 1985/2001; Vrij 2000).

Sometimes liars find it difficult to lie, as they have to think of plausible answers, avoid contradicting themselves and tell a lie that is consistent with everything which the observer knows or might find out, whilst avoid making slips of the tongue. Moreover, they have to remember what they have said, so that they can say the same things again when asked to repeat their story (Burgoon, Buller, and Guerrero 1995; Vrij 2000).

Liars may worry that several cues will give their lies away, and therefore will try to suppress such signs, engaging in impression management in order to avoid getting caught (Buller and Burgoon 1996; Burgoon and Buller 1994; Burgoon, Buller, Floyd, and Grandpre

1996; Burgoon, Buller, White, Afifi, and Buslig 1999; Krauss 1981), that is, trying to make a convincing impression. However, this is not easy. They should suppress their nervousness effectively, should mask evidence that they have to think hard, should know how they normally respond in order to make an honest and convincing impression, and should show the responses they want to show. It may well be the case that, when controlling their behavior, liars may 'over-control' their behavior, resulting in exhibiting a pattern of behavior that will appear planned, rehearsed, and lacking in spontaneity. For example, liars may believe that movements will give their lies away (Hocking and Leathers 1980; Vrij and Semin 1996), and will therefore move very deliberately and tend to avoid any movements that are not strictly essential. This will result in an unusual degree of rigidity and inhibition, because people do normally make movements which are not essential (DePaulo and Kirkendol 1989).

It is also likely that liars will think that the use of speech hesitations and speech errors sound dubious (Hocking and Leathers 1980; Vrij and Semin 1996). Therefore they will try to avoid making such nonfluencies. This, however, may result in a speech pattern which sounds unusually smooth, as it is normal for most people to make some errors in speech (Vrij and Heaven 1999). Impression management might also result in liars being reluctant to say certain things (for example, they might be reluctant to spontaneously admit that what they previously said was incorrect) as they will fear that this will make their stories appear less convincing.

Another possible cue that may result from inadequate control of behavior is that performances may look flat due to a lack of involvement (Burgoon and Buller 1994; Burgoon et al. 1995; DePaulo et al. 2003, but see Burgoon et al. 1999; White and Burgoon 2001, for possible changes in this pattern over time). An artist who applies for a job as salesperson because he needs the money may not look convincingly enthusiastic during the selection interview. A mother who punishes her child for wrongdoing might not look sincere if she, in fact, was amused by the child's behavior.

All three processes may occur at the same time. That is, liars could be nervous, having to think hard, and trying to control themselves all simultaneously. Which of these processes is most prevalent depends on the type of lie. Liars will be more nervous when the stakes (negative consequences of getting caught and positive consequences of succeeding) are high, hence nervous responses are more likely to occur in high stake lies. Liars have to think harder when the lie is complicated, therefore indicators of increased cognitive load are more likely to occur in complicated lies than in easy lies. Liars who are motivated to avoid getting caught may try harder to make an honest impression than those who are less motivated. Therefore, attempts to control behavior, voice and speech may especially occur in motivated liars.

Before discussing the outcomes of reviews about how liars respond, it should be emphasized that the approaches only suggest that the presence of signs of emotions, content complexity and impression management *may* be indicative of deception. None of these approaches claim that the presence of these signs *necessarily* indicates deception. Truth tellers might experience exactly the same processes. For example, innocent (truthful) suspects might also be anxious if they worry that they will not be believed by a police officer (Ofshe and Leo 1997). Because of that fear, they may show the same nervous reactions as guilty liars who are afraid of being caught (Bond and Fahey 1987). This puts the lie detec-

tor in a difficult position. Should the signs of fear be interpreted as signs of guilt or of innocence? The behavior doesn't provide the answer. Ekman (1985/2001) labeled the false accusation of a truth teller on the basis of the behaviors s/he displays the *Othello error*, after Shakespeare's play. Othello falsely accused Desdemona (his wife) of betrayal. He told her to confess since he was going to kill her for her treachery. Desdemona asks Cassio (her alleged lover) to be called so that he can testify her innocence. Othello tells her that he has already murdered Cassio. Realizing that she cannot prove her innocence, Desdemona reacts with an emotional outburst. Othello misinterprets this outburst as a sign of her infidelity.

Cues to deceit

Nonverbal and auditory cues

Recent reviews about nonverbal and auditory cues to deceit, including more than 120 studies, have revealed a limited subset of nonverbal and auditory cues that are reliably associated with deception (DePaulo et al. 2003; Vrij 2000).

Liars tend to have *a higher pitched voice* than truth-tellers, which is probably caused by arousal (Ekman, Friesen, and Scherer 1976). The results concerning *speech errors* (word and/or sentence repetition, sentence change, sentence incompletions, slips of the tongue, and so on) and *speech hesitations* (use of speech fillers such as "ah", "um", "er" and so on) show a conflicting pattern. In some studies an increase in such errors (particularly word and phrase repetitions) and hesitations during deception have been found, whereas other studies have revealed the opposite pattern. There is some evidence that variations of lie complexity are responsible for these conflicting findings (Vrij and Heaven 1999). Lies which are difficult to tell result in an increase in speech errors and speech hesitations (in line with the content complexity approach), whereas lies which are easy to tell result in a decrease in speech hesitations and speech errors (in line with the attempted control approach). Moreover, compared to truth tellers, liars tend to sound vocally *less expressive, more passive, more uncertain* and *less involved* (which might be the result of an overcontrol of behavior) and *more tense* (which might be the result of arousal). They also come across as being *less cooperative* and their faces appear *less pleasant*. Both might be caused by a negative emotion felt by the liar.

Finally, liars tend to make *fewer illustrators* (hand and arm movements designed to modify and/or supplement what is being said verbally) and *fewer hand and finger movements* (non-functional movements of hands and fingers without moving the arms) than truth tellers. The decrease in these movements might be the result of both lie complexity (Ekman and Friesen 1972) and attempted control.

In particular, Ekman's (1985/2001) work has shown that lies may also result in fraudulent facial emotional expressions, so-called "micro-expressions". These are facial expressions that are displayed for only a fraction of a second but clearly reveal the liar's true feelings before being quickly covered with a false expression.

Perhaps a striking finding of the literature is that liars do not seem to show clear patterns of nervous behaviors such as gaze aversion and fidgeting. However, this might be

the result of an artefact. Deception research has almost exclusively been conducted in university laboratories where people (mostly college students) tell the truth or lie for the sake of the experiment. Perhaps in experimental laboratory studies the stakes are not high enough for the liar to elicit clear deceptive cues to deception (Miller and Stiff 1993).

In the most comprehensive study of real life high stake lies to date, Mann (2001), examined, amongst others, the behavior displayed by 13 male suspects during their police interviews (see also Mann, Vrij, and Bull 2002; Vrij and Mann 2003). The suspects were all being interviewed in connection with serious crimes such as murder, rape and arson. Truthful and deceptive behaviors were coded and compared (for each suspect both truthful and deceptive fragments were available). The results revealed that the suspects in these high stake situations also did not show clear nervous behavior when they were lying. In fact, they showed a decrease in limb movements when they lied which is more in line with the content complexity and attempted control approaches than with the emotional approach. The strongest evidence that content complexity more than nervousness has affected suspects' behavior was the finding regarding eyeblinks. Suspects made fewer blinks when they lied. Research has shown that nervousness results in an increase in eyeblinking (Harrigan and O'Connell 1996; Tecce 1992), whereas increased cognitive load results in a decrease (Wallbott and Scherer 1991).

The predominance of cognitive load processes compared to emotional processes in suspect interviews is perhaps not surprising. Many suspects have had prior regular contact with the police. In that respect they are probably familiar with police interviews which might decrease their nervousness during those interviews. However, suspects in police interviews are often not very bright, and are, on average, less intelligent than the average person (Gudjonsson 1992). There is evidence that less intelligent people will particularly have difficulty in inventing convincing stories (Ekman and Frank 1993).

Also other high-stake lie investigations, such as the examination of the behavior of a convicted murderer during his police interview (Vrij and Mann, 2001) and the examination of Saddam Hussein's behavior during a CNN television interview during the Gulf War (Davis and Hadiks 1995) did not show signs of nervousness. In fact, the studies revealed that the convicted murderer and Saddam Hussein both showed a decrease in hand and arm movements when they were lying. In other words, these high stake investigations show findings similar to those of studies with college students.

Verbal cues to deceit: Criteria-based content analysis

For decades, psychologists have looked at verbal criteria which might distinguish truths from lies. *Statement Validity Assessment* (SVA) is the most popular technique to date for measuring the veracity of verbal statements (Vrij 2000). The technique was developed in Germany to determine the credibility of child witnesses' testimonies in trials for sexual offences. To date, SVA assessments are accepted as evidence in criminal courts in several countries, such as Germany, the Netherlands, and Sweden (Vrij 2000).

The SVA method was developed through German psychologists' clinical experience (rather than via experimental research) since the 1930s. The first comprehensive descrip-

tion of SVA was published by Undeutsch (1967) in German. SVA was further developed and refined by Steller and Köhnken who published an English (and final) version in 1989.

One part of SVA is what is known as Criteria-Based Content Analysis (CBCA), the systematic assessment of the credibility of a verbal statement. In order to extract a statement, children are interviewed following a 'structured interview' procedure. Strict guidelines for interviewing children have been laid down in recent years (Bull 1998). They include the necessity to build a good rapport with the child, and endeavoring for as full a free narrative regarding the event as possible (particularly important for SVA). Finally, questioning should begin with very open ended questions becoming increasingly narrowed to obtain more specific details, bearing in mind that each statement must stand up in a court of law and therefore should contain a minimal amount of leading questions (Bull 1998).

These interviews are audiotaped and then transcribed for CBCA coding. The assessment takes place on the basis of these written transcripts, with 19 criteria used in the CBCA assessment. Trained evaluators examine the statement and judge the presence or absence of each of the 19 criteria. The presence of each criterion in the statement enhances the quality of the statement and strengthens the hypothesis that the account is based on genuine personal experience. This idea is originally stated by Undeutsch (1967), and therefore known as the *Undeutsch Hypothesis* (Steller 1989).

Vrij (2000) gives a detailed overview of the 19 criteria used in CBCA assessments, of which some will be described here. First of all, observers look at the *logical structure* of the statement. This criterion is concerned with whether the statement fits together. A second criterion is *unstructured production*. Liars tend to tell their stories more in chronological order (this happened first, and then this, and then that, and so on), than truth tellers, who tend to give their account in unstructured and incoherent ways, particularly when talking about emotional events. A third criterion is the *number of details* mentioned in a statement. It is hypothesized that liars include fewer details in their accounts than truth tellers do. The type of details CBCA experts are looking for include: *contextual embedding* (does the statement contain details about times and locations), *reproduction of speech* (did the interviewee recall literally what has been said during the event), *unusual details* (are there any details mentioned which are 'odd' but not unrealistic), *accounts of subjective mental state* (does the statement include details about how the interviewee actually felt during the event).[2]

The criteria mentioned so far might differ between truth tellers and liars because they are believed to be too difficult for people to fabricate (Köhnken 1999; Steller 1989). This is similar to the cognitive complexity approach described earlier. Other criteria differ between liars and truth tellers for motivational reasons (Steller 1989). This is related to the attempted control approach described earlier. Liars will try to construct a report which they believe will make a credible impression on others, and will omit information which, in their view, will damage their image of being a sincere person (Köhnken 1999). Motivation-based criteria include: *spontaneous corrections* (when the person spontaneously admits that the previous description was incorrect and modifies that description), *admitting lack of memory* (spontaneous admission of not remembering some (crucial) details), and *raising doubts about one's own testimony* (spontaneously admitting that the description sounds odd or implausible).

In order to test whether the CBCA approach actually works and can discriminate between truthful and fabricated accounts, both field studies and laboratory studies have been conducted. In field studies, researchers have evaluated CBCA assessments made in actual sexual abuse cases. The problem with field studies is that it is often difficult to establish the exact facts of the case, and to establish with certainty whether the statement was actually truthful or not. Obviously, to know the "ground truth" (to know whether the statement was actually truth or false) is essential to test the accuracy of CBCA assessments. In many field studies, however, the ground truth is not always assured, and the results of field studies are therefore often difficult to interpret (Vrij 2000). Laboratory studies are problematic as well. In real life, CBCA assessments are made solely on statements given by alleged child victims of sexual abuse. In other words, this involves statements describing highly emotional events. Obviously, laboratory studies can never simulate those types of experiences. Many CBCA experts therefore believe that laboratory studies are of little use in testing the accuracy of SVA assessments (Vrij 2000).

Some authors describe CBCA as a technique solely to evaluate statements of children who are alleged victims in sexual abuse cases, as the technique is developed for this purpose (Raskin and Esplin 1991). Others have advocated the additional use of the technique to evaluate the testimonies of suspects or adult witnesses who talk about issues other than sexual abuse. They pointed out that the underlying Undeutsch hypothesis is neither restricted to children, witnesses and victims nor to sexual abuse (Köhnken, Schimossek, Aschermann, and Höfer 1995).

Vrij (2000) reviewed 17 studies related to CBCA, most of them (12) were laboratory studies, and in most of these (9) the statements which were assessed were given by adults. As was the case with the relationship between nonverbal and auditory cues and deception, there is no typical speech content related deceptive response. That is, not all liars say or avoid saying specific things. However, the criteria discussed above (with the exception of admitting lack of memory) are often found to be present more in truthful statements than in deceptive statements (in both adults and children), supporting the Undeutsch-Hypothesis.

Verbal cues to deceit: Reality monitoring

Recently, Reality Monitoring (RM) has been used as an alternative method to measure verbal differences between responses believed to be true and false (Alonso-Quecuty 1992, 1996; Hernandez-Fernaud and Alonso-Quecuty 1997; Höfer, Akehurst, and Metzger 1996; Manzanero and Diges 1996; Roberts, Lamb, Zale, and Randall 1998; Sporer 1997; Vrij, Edward, Roberts, and Bull 2000; Vrij, Edward, and Bull 2001a,c; Vrij, Akehurst, Soukara, and Bull in press). At the core of Reality Monitoring is the claim that memories of experienced events differ in quality from memories of imagined events. Memories of real experiences are obtained through perceptual processes and are therefore likely to contain, amongst other things, *perceptual information* (*visual details* (descriptions of what has been seen: "I walked in to the room", contains three visual details), and *auditory details* (details about what has been heard: "She said to sit down" contains one auditory detail)), *spatial*

details (details about where the event took place ("I walked in to the *room*"), details about how objects and people were situated in relationship to each other ("he stood behind me")), and *temporal details* (details about time order of the events ("first he switched on the video-recorder and then the TV"), and details about duration of events ("we were playing for a while")).

Accounts of imagined events are derived from an internal source and are therefore likely to contain *cognitive operations*, such as thoughts and reasonings ('I must have had my coat on, as it was very cold that night'; 'she was quite tall for a girl') (Johnson, Hashtroudi, and Lindsay 1993; Johnson and Raye 1981, 1998). One might argue that 'experienced events' reflect truth telling whereas 'imagined events' reflect deception. Therefore, differences between truth tellers and liars could be expected in Reality Monitoring criteria. In support of this assumption, studies have revealed that truth tellers do include more visual, audi-tory, spatial and temporal details than liars (see Vrij 2000, for a review). In a recent study (Vrij et al. in press) it was also found that liars, on the other hand, are likely to include more cognitive operations in their statements than truth tellers.

Detecting deceit via a systematic analysis of nonverbal, auditory and speech content related cues

In recent years we have conducted two studies in which we attempted to detect deceit in an objective and systematic manner. That is, in both studies we calculated the frequency of occurrence of various nonverbal, auditory and speech content related cues which, accord-ing to previous research, are "reliable"[3] cues to deception. We then made truth/lie decisions utilizing multiple cue models which were based upon these reliable cues.

In Vrij et al.'s (2000) experiment, 73 nursing students either told the truth or lied about a film they had just seen. Compared to truth tellers, liars showed fewer illustrators, fewer hand and finger movements, more speech hesitations, and a longer response latency (pe-riod of silence between question and answer). Liars also had a lower total CBCA score (CBCA criteria combined) and lower Reality Monitoring score (RM criteria combined except cognitive operations).

In Vrij et al.'s (in press) study, 52 undergraduate students participated in 'playing a game of Connect 4 and rubbing the blackboard' event. In a subsequent interview they told the truth or lied about the event. This study revealed fewer cues to deceit, but most of the cues that were found were the same cues found in Vrij et al. (2000). Compared to truth tellers, liars showed fewer hand and finger movements, and obtained lower CBCA- and Reality Monitoring scores. Finally, liars included more cognitive operations in their statements than truth tellers.

In order to examine to what extent liars and truth tellers could be correctly classified on the basis of such cues, discriminant analyses were conducted in both studies. Table 1 pro-vides a summary of the outcomes of these analyses.

In these analyses, the objective truth status was the classifying variable, and, in Vrij et al.'s (2000) experiment, total CBCA score, total Reality Monitoring score, response latency, speech errors, speech hesitations, speech rate, illustrators and hand and finger movements

Table 1. Discriminant analyses with nonverbal behavior, criteria-based content analysis and reality monitoring

	Hit rates						
Detection technique	Lie	Truth	Total	Eigenvalue	Lambda	df	X2
Vrij et al. (2000)	85%	77%	81%	0.77	0.57	6	38.79**
CBCA + RM + nonverbal/auditory cues							
Vrij et al. (in press)	89%	88%	88%	1.09	0.48	7	34.29**
CBCA + RM[1] + nonverbal/auditory cues							
Replication of Vrij et al. (2000)	81%	77%	79%	0.64	0.61	4	23.83**
with Vrij et al. (in press) data							
CBCA + RM + nonverbal/auditory cues							

[1]In Vrij et al. (in press) RM represents two variables: the total Reality Monitoring score and the cognitive operations variable *p < 0.05, **p < 0.01.

were the dependent variables. Different discriminant analyses were conducted, for non-verbal/auditory responses and speech content related responses separately and for the non-verbal/auditory and speech content related responses combined. The combined analyses revealed the most accurate classification of liars and truth tellers with a total hit rate of 81% (85% lie detection hit rate and 77% truth detection hit rate). CBCA score, response latency, hand and finger movements, speech hesitations, illustrators and speech rate contributed to the discriminant function.

In Vrij et al.'s (in press) experiment, total CBCA score, total Reality Monitoring score, cognitive operations, gaze aversion, limb movements (illustrators, self manipulations, hand and finger movements and foot and leg movements combined), response latency, pauses, speech disturbances (speech errors and speech hesitations combined), and speech rate were included as dependent variables. Again, the combined analysis revealed most accurate hit rates, with a total hit rate of 88% (88% lie detection and 89% truth detection). Reality Monitoring total score, frequency of pauses, cognitive operations, latency period, limb movements, CBCA total score and gaze aversion contributed to the discriminant function.

Although there was some overlap between the two discriminant functions (total CBCA score and response latency emerged in both functions), they were not identical. DePaulo, Anderson, and Cooper (1999) correctly pointed out that this lack of replication is problematic, as it does not provide a set of variables on which someone can reliably build upon in lie detection. However, it is not possible to compare both discriminant functions, as in both discriminant analyses different dependent variables were entered.

In order to seek replication of Vrij et al.'s (2000) findings, an additional discriminant analysis was carried out with the data reported in Vrij et al. (in press). This time the dependent variables which were included in Vrij et al.'s (2000) study (total CBCA score, total Reality Monitoring score, latency period, speech errors, speech hesitations, speech rate, illustrators and hand/finger movements) were included. The hit rates obtained with the Vrij et al. (in press) data were very similar to the findings obtained with the Vrij et al. (2000) data: 81% hit rate for lie detection, 77% hit rate for truth detection and 79% total hit rate. In the Vrij et al. (in press) data four variables contributed to the discriminant function: la-

tency period, total Reality Monitoring score, hand and finger movements and speech errors. In other words, there was an overlap of two cues between the Vrij et al. (2000) and Vrij et al. (in press) data sets (latency period and hand and finger movements). In both analyses deception was associated with an increase in latency period and a decrease in hand and finger movements.

Guidelines to detect deception

Cues to examine

In our view, the findings presented in this article illustrate the benefit of looking at certain cues in a systematic manner in order to detect deceit. Which nonverbal, auditory and speech content related cues lie detectors should particularly focus upon is hard to say. Typical deceptive responses do not exist and responses might differ per situation and per individual. However, there is growing evidence that CBCA scores, Reality Monitoring scores and some nonverbal cues, particularly illustrators and hand and finger movements are useful to look at. It sounds reasonable to suggest that the more these cues occur simultaneously in a person's response, the more likely it is that the person is lying. Our own study (Vrij et al., 2000) showed that lie detection with each of the cues individually did not result in high hit rates. In other words, it is essential to work with *multiple* cue models.[4]

Using Reality Monitoring assessments to distinguish between liars and truth tellers is relatively new but in our view promising. Hit rates of correct classifications of truth tellers and liars are around 70% (Sporer 1997; Vrij et al. 2000, in press) which are comparable with CBCA hit rates, which are typically about 70% as well (see Vrij 2000, for a review). The benefit of Reality Monitoring assessments, compared to CBCA assessments, is that it is easier to teach coders the Reality Monitoring method. There is an overlap between the two verbal methods, as both CBCA and Reality Monitoring coding occurs on the basis of written transcripts. However, applying the Reality Monitoring method is less time-consuming as there are fewer criteria to examine. Moreover, the individual criteria are more clearly defined and, as a result, interrater reliabilities between coders are usually higher for Reality Monitoring assessments than for CBCA assessments (Sporer 1997; Vrij et al. 2000, in press).

Baseline method

The fact that people don't have standard reactions when they lie, probably makes a baseline comparison method useful. Baseline comparison refers to comparing the response under investigation with someone's natural truthful response. A deviation from that response might indicate that a person is lying. However, a lie detector should keep in mind that a deviation does not necessarily indicate deception (see for example the Othello-error). Research has consistently indicated that people become better at detecting truths and lies when they are familiar with the truthful behavior of the person they have to judge (Brandt, Miller, and

Hocking 1980a,b, 1982; Feeley, deTurck, and Young 1995; Seager 2001). For example, Feeley and his colleagues exposed some observers to baseline interviews of the people they had to assess in the lie detection task. Their hit rates were significantly higher (72%) than the hit rates of observers (56%) who were not exposed to baseline interviews prior to the lie detection task.

However, the baseline method will only work if the method is applied correctly. Crucial in the use of the baseline technique is that the correct parts of the interview are compared. Suppose a colleague with whom you are on friendly terms initiates a casual chat. After a while he tells you that people at work have come to the conclusion that you are responsible for the breakdown of expensive equipment yesterday, which made your boss extremely angry! You didn't touch the machine, so you know that the accusation is false, and that is what you immediately say to your colleague. However, the false accusation clearly upsets you and makes you react nervously. What makes them suspect you? Your colleague notices your nervous reactions and subsequently accuses you of lying. Your colleague makes a serious (but common) mistake. Indeed, you are nervous, but it is the accusation itself that makes you nervous! The situation you are in at the moment is totally different from the situation before the accusation. Comparing your current reactions with your reactions before the accusation is not legitimate. The situations before and after the accusation are not comparable, and changes in your behavior caused by the accusation can say nothing about whether or not you are lying. In other words, one should not compare apples with oranges, but should compare the response under investigation with a *comparable truth*, that is, truthful response exhibited in a similar situation. Unfortunately, in police interviews comparisons between someone's response during small talk and their reaction during an actual interrogation (apple - orange comparison) is common practice (Moston and Engelberg 1993). It is probably unfair to blame police officers for making this mistake. They are advised to establish a baseline in this way in popular and frequently read police manuals, such as the American manual written by Inbau, Reid, and Buckley (1986). (A new edition of this manual, Inbau, Reid, Buckley, and Jayne (2001), has recently been published). See Vrij and Mann (2001) how during interviews fair truth – lie comparisons can be made.

Information-gathering style

Lie detection is probably easier when lie detectors employ an information-gathering communication style (where they encourage people to talk or write) compared to an accusatory communication style (where they confront people with circumstantial evidence or are simply accused of lying). Cognitive difficulties liars might face, as described in the content complexity approach, particularly occur when liars are encouraged to talk or write. Throughout their lies, liars have to think of plausible answers, should not contradict themselves, should report a lie that is consistent with everything which the observer knows or might find out, should avoid making slips of the tongue, and should try to make an honest (convincing) impression. Moreover, they have to remember what they have previously said or written, so that their story remains consistent when someone asks them to repeat it. This is by no means an easy task and therefore it sounds plausible that the more a liar talks or

writes, the more likely it is that he or she (finally) will give his or her lies away via speech content or nonverbal/auditory cues (as they continuously have to monitor both speech content and nonverbal/auditory behavior).

Inbau and his colleagues (Inbau et al. 1986/2001) advise (criminal) investigators to confront suspects with pieces of evidence they have already gathered. They hereby try to show suspects that it is meaningless to remain silent and that it might be better for them to talk. This interview style will hamper lie detection. One of the difficulties for liars is that they do not know what the observer knows. They therefore do not know what they can say without running the risk of being caught out. By disclosing to suspects the facts they know, criminal investigators reduce the uncertainty of lying for suspects and make it easier for them to lie.

Also accusing people of lying by referring to their behavior: "You are lying, I can see that in your eyes!" (Inbau et al. 1986, 2001) is unfortunate, as it gives people the ideal opportunity to "escape" from the interview situation. They might tell interviewers that they no longer wish to continue co-operating with the investigation, as further interviewing would not make sense given the fact that they (the interviewers) do not believe them (the interviewee) anyway. Also, it should be kept in mind that accusing someone in itself might elicit response changes (Othello-error).

The first contact

Lie detection is perhaps easier during the first contact than during subsequent interactions. During the first contact, interviewees may not yet be fully prepared and may not have worked out their response strategy. For example, members of the resistance during the Second World War who were caught by the Germans and were subsequently interviewed by German police were often poorly prepared for those interviews (J. Vrij 2001). All their precaution activities were focused on avoiding getting caught by the German police, and the equally important aspect of what to say if they were captured was ignored.

In addition, after the initial phase of an interaction, interview dynamics are probably going to play an important role which makes interpreting the responses of the alleged liar more complex. For example, the interaction may create suspicion in the interviewer and this suspicion, in turn, may affect the interviewee's reaction (Bond and Fahey 1987; Buller, Stiff, and Burgoon 1996; Burgoon, Buller, Dillman, and Walther 1995; Burgoon et al. 1996). Also, it is known that when people communicate with each other, matching and synchrony takes place (Akehurst and Vrij 1999; Burgoon et al. 1995, 1996, 1999; Chartrand and Bargh 1999). People may mirror each other's posture or they may converge in how quickly and how loudly they speak. They may also reciprocate each other's gazing, nodding and smiling behavior, and even accents can converge (DePaulo and Friedman 1998). This effect, recently labelled "the chameleon effect" (Chartrand and Bargh 1999) emerges even when total strangers interact with each other and it happens within a few minutes (Akehurst and Vrij 1999; Chartrand and Bargh 1999). Akehurst and Vrij (1999) found that when in a simulated police interview the police detective made grooming gestures, the "suspects" mimicked these mannerisms within one minute. As a result, as the communication progresses

the responses of the interviewee might become influenced by the responses of the interviewer.

Implicit lie detection

Which behavioral and auditory cues do people think are associated with deception? In general terms, people probably find those behaviors suspicious that deviate from a normal or expected pattern (Basket and Freedle 1974; Bond, Omar, Pitre, Lashley, Skaggs, and Kirk 1992; Burgoon, Buller, Ebesu, White, and Rockwell 1996). However, surveys have indicated that people, both laypersons and police officers, particularly associate gaze aversion and fidgeting with deception (Akehurst, Köhnken, Vrij, and Bull 1996; Mann 2001; Vrij and Semin 1996). For example, around 75% of police officers believe that liars look away (Mann 2001; Vrij and Semin 1996). One explanation of why police officers endorse this view is that police manuals typically promote the idea that liars look away and fidget (Gordon and Fleisher 2002; Hess 1997; Inbau et al. 1986, 2001). As already discussed above, there is no empirical evidence to suggest that liars actually exhibit such behaviors. Unfortunately, the manuals which make such claims also do not present research data to support these suggestions.

Such inaccurate views about cues to deception hampers lie detection. In two recent studies where we examined the relationship between cues which people think are associated with deception and their ability to detect deceit, we found that police officers who endorse the views that liars fidget and look away are the worst lie detectors (Mann, Vrij, and Bull in press; Vrij and Mann 2001). This may well explain why, contrary to what seems reasonable, people who have access to the full picture of a liar often have more difficulty in detecting deceit (DePaulo et al. 1985; Wiseman 1995). When watching the full picture, powerful but misleading cues such as gaze and fidgeting are available, whereas such cues are unavailable when reading a text or listening to a voice.

An innovative method of letting people focus on more valid cues to deception is the implicit lie detection method. In Vrij, Edward, and Bull's (2001b) study, police officers watched videotapes of truth tellers and liars. Some participants were asked whether each of the people were lying (explicit lie detection), others were asked to indicate for each person whether that person "had to think hard" (implicit lie detection, they were not informed that some people were actually lying). Police officers could distinguish between truths and lies, but only by using the implicit method. An explanation for this finding is that, when detecting deceit explicitly, police officers rely on their stereotypical views about deceptive behavior, such as "liars look away" and "liars make many movements". As mentioned previously, these stereotypical views are mostly incorrect. While detecting deceit in an implicit way, however, the participants were implicitly directed to look at more valid cues. Indeed, the findings showed that only in the indirect method did the police officers pay attention to the cues which actually discriminated between truth tellers and liars on the videotape, such as a decrease in hand and finger movements. See DePaulo (1994) and A. Vrij (2001) for overviews of implicit lie detection studies.

Discussion

Major conclusions

In this article we have argued that lie detection improves when a variety of verbal and nonverbal/auditory cues are systematically examined. We have also argued that, apart from looking at cues in a more objective and systematic manner, lie detection might improve if certain communication techniques are employed.

Implications for automatic deception detection

For the purpose of automatic detection of deception, computer software programs could be developed to calculate the frequency of occurrence of CBCA and Reality Monitoring criteria in electronic communication. To our knowledge no publications are available regarding this issue but we believe that developing such programs is possible. At the very least, it should be possible to make good estimates of the frequency of occurrence of certain criteria via computer software programs. For example, as mentioned in footnote 2, Lamb et al. (1997) found a very high (0.86) correlation between the number of details present in a statement (one of the CBCA criteria) and length of the statement (calculated via number of words). In other words, calculating the number of words (already available with computer software programs) could provide a good estimate of the number of details present in a statement.

Limitations and advantages

As argued in this article, we believe that looking at a combination of behavioral, auditory and speech content related cues in a systematic manner has clear potential for lie detection, and this potential would be fully exploited if a software program, capable of automatically identifying some of the valid cues (see previous section) could be developed.

   We base this positive message regarding potential lie detection on deception research. However, almost all deception research to date has some important limitations. For example, in deception research, lying typically takes place in a dyad setting (the liar communicates with just one person) and not in a group setting (in which a liar communicates with a group of people). We don't believe this is a serious constraint. The theoretical reasons why cues to deception might occur are the same when people lie in a dyad or in a group. Also, the communication techniques we have discussed are not restricted to a dyad setting either. We therefore believe that the information provided in this article are applicable to group settings as well. The potential to generalise the findings presented in this article might be limited by the consideration that in deception studies, liars and truth tellers typically give *verbal* statements and not *written* statements. Even in assessing verbal cues to deception with methods such as Criteria-Based Content Analysis and Reality Monitoring, researchers obtain verbal statements that are then transcribed. We simply do not know whether the

verbal cues which appear in such transcripts will appear in written statements as well, and we are reluctant to speculate about this. Instead, we recommend further research into this issue.

Concluding remarks

Although typical deceptive responses such as "Pinocchio's growing nose" do not exist, some cues are, to some extent, related to deception. We have argued that looking at such cues in a systematic manner has clear potential for lie detection. We also believe that software programs could be developed, to automatically identify at least some of these cues, paving the way for automatic lie detection.

Acknowledgements

Notes

1. Zuckerman, DePaulo, and Rosenthal (1981), who introduced these three factors, also included a fourth factor in their theoretical model, labeled "arousal". We left this factor out as, in our view, it shows an overlap with the emotion factor. Zuckerman et al. (1981, p. 9) themselves already suggested this by finishing their arousal factor paragraph with the following statement: "It is possible, however, that the general autonomic responsivity to deception reflects specific emotions. If so, cues to deception may be accounted for by the particular affects that are involved rather than by general arousal."
2. The fact that truthful statements contain more details than deceptive statements suggests that truthful statements are likely to be longer than deceptive statements. Indeed, Lamb, Sternberg, Esplin, Hershkowitz, and Orbach (1997) found a very strong correlation ($r = 0.86$) between number of details included in the statement and length of the statement (measured via the number of words), and DePaulo et al.'s (2003) review showed that truthful messages were significantly longer than deceptive messages.
3. The term "reliable cues to deception" always needs to be used with caution, because, as was discussed before, truly reliable cues to deception (Pinocchio's growing nose) do not exist.
4. CBCA scores and Reality Monitoring scores themselves are already multiple cue models.

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