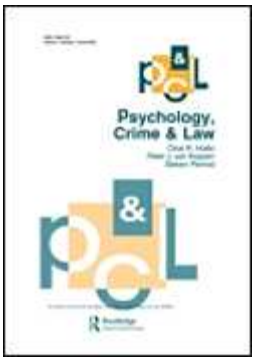

□Look Into My Eyes□: Can an Instruction to Maintain Eye Contact Facilitate Lie Detection?

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Abstract

In two experiments, we tested the hypotheses that (a) the differences in nonverbal and verbal behaviour between liars and truth tellers will be greater when interviewees are instructed to maintain eye contact with the interviewer than when no instruction is given, and (b) instructing interviewees to maintain eye contact with the interviewer will facilitate deception detection. In Experiment 1, 80 mock suspects either told the truth or lied about a staged event and were or were not requested to maintain eye contact with the interviewer. The maintaining eye contact condition contained more cues to deceit than the control condition.

In Experiment 2, 106 undergraduate students either watched or listened to a selection of the videotaped interviews from Experiment 1 and made veracity judgements. The request to maintain eye contact improved students' ability to detect deception in both Video + Audio and Audio conditions. The results of this study are compatible with other studies showing that placing greater cognitive demands on suspects increases the number of cues to deception and also of observers' ability to discriminate between liars and truth tellers.

"Look Into My Eyes":

Can an Instruction to Maintain Eye Contact Facilitate Lie Detection?

In criminal investigations the question of whether the interviewee is lying or telling the truth frequently arises (Horvath & Meesig, 1996). To address this issue, investigators use different lie detection tools, and amongst these, "concern-based" protocols such as the Control Question Polygraph Test (CQT, Honts, 2004) and the Behaviour Analysis Interview (BAI, Horvath, Jayne, & Buckley, 1994; Inbau, Reid, Buckley, & Jayne, 2001) appear to be most popular. The theoretical assumption behind concern-based protocols is that liars are more concerned about being disbelieved than truth tellers when answering specific questions which results in increased arousal (CQT) or in the display of nervous behaviours (BAI). According to the National Research Council (2003), however, this underlying assumption is theoretically weak, and no questions can be formulated that necessarily make liars more concerned than truth tellers (see also Vrij, 2004, 2008).

We have developed another approach to enhance discrimination between liars and truth tellers (Vrij, Fisher, Mann, & Leal, 2006, in press; Vrij, Mann, Fisher, Leal, Milne, & Bull (2007). We assume that, generally, lying is more cognitively demanding than truth telling. Lie detectors could exploit liars' increased cognitive load by introducing mentally taxing interventions. Liars, who need more cognitive resources than truth tellers to produce their statements, will have fewer cognitive resources left over to address these mentally taxing interventions than will truth tellers. This should result in more pronounced differences between liars and truth tellers in terms of displaying signs of cognitive load (e.g., stutters, pauses, slower speech, decrease in movements, less detail) in settings where these cognitively demanding interventions have been introduced than in settings where no such interventions have been

introduced (i.e., cognitive load based protocol). We are aware that the concept of cognitive load as a possible discriminator between truth tellers and liars has already been discussed by others (Zuckerman, DePaulo, & Rosenthal, 1981). However, here we propose the innovative step of transforming that cognitive load variable into a system variable, i.e., manipulating it (by interviewer) to facilitate detecting deception.

In a previous experiment (Vrij, Mann, Fisher et al., 2007) we tested our approach for the first time. We raised cognitive demand in half of our liars and half of our truth tellers by asking them to recall their stories in reverse order. More verbal and nonverbal cues to deception emerged in this high demand condition than in the control condition where no instruction was given. In addition, observers were more accurate in distinguishing between those truth tellers and liars who told their stories in reverse order than in the control condition.

One possible limitation of the reverse order instruction is that, in a real investigation, investigators may be uncomfortable asking suspects to describe events in reverse order. It has been noted, for example, that British police have generally not used the reverse-order instruction within the Cognitive Interview (Fisher & Geiselman, 2002) when interviewing cooperative witnesses (Kebbell, Milne, & Wagstaff, 1999). One reason for this reluctance is that it is an unusual request and may therefore be perceived as odd. Perhaps investigators may feel more comfortable when using requests that are perceived as more regular. An example of such a request, and the one we have examined in the present experiments, is asking interviewees to maintain eye contact with the interviewer. We expected that more nonverbal and verbal differences would emerge between liars and truth tellers in the eye contact maintenance condition than in the control condition (Experiment 1), which should facilitate the observers' task of discriminating between them (Experiment 2).

Cognitive Demand

Lying can be more cognitively demanding than truth telling (DePaulo, Lindsay, Malone, Muhlenbruck, Charlton, & Cooper, 2003; Zuckerman et al., 1981), and several aspects of lying contribute to this increased mental load. First, formulating the lie itself may be cognitively taxing. Second, liars are typically less likely than truth tellers to take their credibility for granted (DePaulo et al., 2003; Gilovich, Savitsky, & Medvec, 1998; Kassin, 2005; Kassin & Gudjonsson, 2004; Kassin & Norwick, 2004; Vrij, Mann, & Fisher, 2006b). As such, liars will be more inclined than truth tellers to monitor and control their demeanour so that they will appear honest to the lie detector (DePaulo & Kirkendol, 1989**), and such monitoring and controlling is cognitively demanding (Baumeister, 1998)**. Third, because liars do not take credibility for granted, they may monitor the *interviewer's* reactions more carefully in order to assess whether they are getting away with their lie (Buller & Burgoon, 1996; Schweitzer, Brodt, & Croson, 2002). Carefully monitoring the interviewer also imposes cognitive load. Fourth, liars may be preoccupied by the task of reminding themselves to act and role-play (DePaulo et al., 2003), which requires extra cognitive effort. Fifth, liars have to suppress the truth while they are lying and this is also cognitively demanding (Spence et al., 2001). Finally, whereas activating the truth often happens automatically, activating a lie is more intentional and deliberate, and thus requires mental effort (Gilbert, 1991; Walczyk, Roper, Seemann, & Humphrey, 2003; Walczyk, Schwartz, Clifton, Adams, Wei, & Zha 2005).

Obviously, lying is not always more cognitively demanding than truth telling (McCornack, 1997). Perhaps the earlier stated reasons given as to *why* lying is more cognitively demanding could give us insight into *when* it is more cognitively demanding. That is, lying is more cognitively demanding to the degree that these six principles are in

effect. For example, lying is likely to be more demanding than truth telling only when interviewees are motivated to be believed. Only under those circumstances can it be assumed that liars take their credibility less for granted than truth tellers and hence will be more inclined than truth tellers to monitor their own behaviour and/or the interviewer's reactions. Second, for lying to be more cognitively demanding than truth telling, liars must be able to retrieve their truthful activity easily and have a clear memory of it. Only when liars' knowledge of the truth is easily and clearly accessed will it be difficult for them to suppress the truth. On the other side of the equation, truth tellers also need to have easy access to the truth for the task to be relatively undemanding. If truth tellers have to think hard to remember the target event (e.g., because it was not distinctive or it occurred long ago **and was either not meaningful or not rehearsed**), their cognitive demands may exceed the cognitive demands that liars require for fabricating a story.

In experimental studies researchers ensure that interviewees are motivated (typically by giving a reward for making a credible impression) and that the target event is easily retrieved (typically by interviewing the suspects shortly after informing them about the target event). In those experiments lying has been found to be more demanding than truth telling in various settings. **First, in many studies participants were requested to report the cognitive load they experienced while lying or truth telling. Those studies systematically showed that lying is more cognitively demanding than truth telling**. This occurred not only when lengthy, elaborative responses, were required (Granhag & Strömwall, 2002; Hartwig, Granhag, Strömwall, & Kronkvist, 2006; Strömwall, Hartwig, & Granhag, 2006; Vrij, Edward & Bull, 2001b; Vrij & Mann, 2006; Vrij, Mann, & Fisher, 2006b; White & Burgoon, 2001), but also when short responses were sufficient (Caso, Gnisci, Vrij, & Mann, 2005; Vrij, Mann, & Fisher,

2006b; Vrij, Semin, & Bull, 1996**). Second**, in fMRI deception research, lying and truth telling is differentiated only by the act of pressing either a "lie" or "truth" button. Nevertheless, participants' brain activity reveals that lying is more cognitively demanding than truth telling (Spence, Hunter, Farrow, Green, Leung, Hughes, & Ganesan, 2004).

In forensic settings, we can reasonably assume that interviewees will be motivated to be believed, but we cannot assume that interviewees will always be able to retrieve the target event easily, as this will vary from one case to another. Analyses of police interviews with real-life suspects, however, suggests that lying is often more cognitively demanding than truth telling in the forensic setting. First, in those police interviews, lies were accompanied by increased pauses, decreased blinking, and decreased hand and finger movements, all of which are signs of cognitive load (Mann, Vrij, & Bull, 2002; Vrij & Mann, 2003). Second, police officers who saw videotapes of these suspect interviews reported that the suspects appeared to be thinking harder when they lied than when they told the truth (Mann & Vrij, 2006).

Magnifying the Differences between Liars and Truth Tellers by Increasing Cognitive Load

One way to pose excessive cognitive demands on interviewees is by asking them to maintain eye contact with the interviewer. People typically switch their gaze between looking at and away from their conversation partner. Although the amount of eye contact varies depending on whether a person is speaking or listening and between situations and individuals, maintaining full eye contact when speaking is extremely rare (Kleinke, 1986; DePaulo & Friedman, 1998). One reason why people look away when they speak is to manage their cognitive load (Doherty-Sneddon, Bruce, Bonner, Longbotham, & Doyle, 2002; Doherty-Sneddon & Phelps, 2005;

Glenberg, Schroeder, & Robertson, 1998). When they need to concentrate on what to say, people prefer to switch off from environmental stimulation either by closing their eyes or focussing on an information-poor aspect of the environment, such as a ceiling, wall, floor etc. By asking people to maintain eye contact, this commonly used and often unconscious strategy to reduce cognitive demand cannot be employed, and as a result, the interviewee is likely to experience cognitive load.

Verbal and Nonverbal Cues of Cognitive Load

We examined several verbal and nonverbal cues that are associated with cognitive load.

Verbal Cues

Describing events in detail is typically more cognitively challenging for liars than for truth tellers (Köhnken, 1996, 2004; Vrij, 2005, 2008). Liars may lack the imagination to invent many details, or they may find it difficult to fabricate a detailed story that sounds plausible. Verbal lie detection tools that assess the number of details mentioned by interviewees, such as Criteria-Based Content Analysis (Vrij, 2005) and Reality Monitoring (RM) (Masip, Sporer, Garrido, & Herrero, 2005), distinguish between general categories of details and more specific types of details. In the present experiment we examined only general categories of details: Visual details (details about what the interviewee saw), auditory details (details about what the interviewee heard), spatial details (details about locations, "the stool was underneath the table") and temporal details (details about time, "about one minute later…"). We also examined the extent to which participants recalled the event in chronological order. Recalling events in non-chronological order is cognitively more difficult than recalling events in chronological order (**Zaparniuk, Yuille**, & Taylor, 1995). Since we assume that lying is more cognitively demanding than truth telling, and that telling

a story whilst maintaining eye contact is more cognitively demanding than telling a story without such an instruction, **we hypothesised that liars would include fewer visual, auditory, spatial and temporal details in their stories and would recall their stories in a more chronological order than truth tellers (main effect of Veracity); more important, we hypothesised that the cognitive overload associated with lying would manifest itself, particularly in the Eye Contact condition (Veracity X Eye Contact interaction effect).**

The final verbal cue we examined was cognitive operations, a cue belonging to the RM tool. This category varies in its definition among RM researchers (Masip et al., 2005). Here we define cognitive operations to refer to evidence in the narratives of various cognitive activities, such as thoughts or reasonings ("I must have had my coat on, as it was very cold that night") and cognitive suppositions of sensory experiences , e.g., "She seemed quite clever" (Vrij, Mann, Kristen, & Fisher, 2007). Since cognitive operations refer to cognitive activities, we could expect cognitive operations to be more frequent in situations where people carry out many cognitive activities, as in situations with high cognitive load. We thus predicted that liars would include more cognitive operations into their accounts than truth tellers **(Veracity main effect)**, **particularly in the Eye Contact condition (Veracity X Eye Contact interaction).**

Vocal Cues

We examined several vocal cues that are associated with cognitive load. Research has demonstrated that more pauses (between words or sentences), more speech hesitations (use of speech fillers such as “um”, “uh”, “er” etc), more speech errors (grammatical errors, stutters, false starts etc.) and a slower speech rate are all associated with cognitive load (Goldman-Eiser, 1968; Smith & Clark, 1993; Sporer & Schwandt, 2006). **We therefore predicted that, in comparison to truth**

tellers, liars would demonstrate more pauses, speech hesitations and speech errors, and would speak slower (Veracity main effect), particularly in the Eye Contact condition (Veracity X Eye Contact interaction effect).

Visual Cues

Research has indicated that people tend to decrease several kinds of movements when they have to think hard (Ekman, 1997; Ekman & Friesen, 1972). This decrease occurs because cognitive demand results in a neglect of body language, reducing overall animation. We looked at several types of movements: Illustrators (gestures that accompany speech), hand/finger movements (movements of hand and fingers without arms being moved), eye blinks, and leg and foot movements. We predicted that liars would show fewer illustrators, hand/finger movements, eye-blinks, and leg/foot movements than truth tellers, particularly in the Eye Contact condition **(Veracity X Eye Contact interaction effect).**

EXPERIMENT 1

Method

Participants

Eighty undergraduate students participated: 45 males and 35 females. Their average age was $M = 20.70$ ($SD = 3.47$) years.

Procedure

The experiment took place at a Students' Union in a British university. Undergraduates were recruited under the guise of participating in an experiment about 'telling a convincing story' with the possibility of earning **£10**. The participants signed an informed consent form, and then were randomly allocated to the truth telling condition or the deception condition.

The 40 truth tellers participated in a staged event in which they played a game

of Connect 4 with a confederate (who posed as another participant).[i] During the game they were interrupted twice, first by another confederate who came in to wipe a blackboard and later by a third confederate who entered looking for his or her wallet. Upon finding the wallet, this latter confederate then claimed that a £10 note had gone missing from it. The participant was then told that s/he would be interviewed about the missing money. We used the same event as Vrij, Mann, and Fisher (2006a, b), Vrij, Mann, Kristen, & Fisher (2007), and Vrij, Mann, Fisher, Leal, Milne, and Bull (2007).

The 40 liars did not participate in this staged event. Instead, they were asked to take the £10 from the wallet, but deny having taken this money in a subsequent interview. They were told to tell the interviewer that they played a game of Connect 4 just as the truth tellers had. **The liars were then presented with a document containing the following information about the staged event that the truth tellers had participated in.**

> **'You enter the room to find another participant, 'Sam', and the two of you play Connect 4 alone together for a while. You sat where you are sitting now and the other participant sat opposite you. You had a general conversation with the other participant as you played, until the other participant's mobile phone rang and they excused themselves and left the room, leaving you alone for a minute or so. When they returned you continued playing the game. Then someone else entered the room, made a comment about you playing the game, wiped the mathematical formulas that you can see off the board and then left. You continued playing the game when someone else entered the room looking for his/her wallet. The wallet which you can see in front of you, is found somewhere around the**

room (up to you to decide where – it was varied in the scenario). You continue playing the game when the experimenter came back in, with the wallet-owner, and informs you both that some money had gone missing from the wallet and you are both to be interviewed.'

In summary, the liars did not engage in any of the activities that the truth tellers had engaged in (playing Connect 4, etc.). Instead, the liars took the money out of the wallet, hid it somewhere on their person, and pretended that they had been engaged in the truth tellers' activities. They therefore lied about the entire scenario, including taking £10 from the wallet. The procedure reflects a situation where a liar is familiar with the event s/he describes but lacks the experience of true participation in that event.

Both liars and truth tellers were told that if they convinced the interviewer that they did not take the money, they would receive £10 for participating in this study. If they did not convince the interviewer, they would instead have to write a statement about what actually occurred. The participants were then brought to the interview room where they were interviewed by a uniformed, male, British police officer. The interviewer was blind to the participants' condition (truth telling or lying). The interviewer started the interview by saying "£10 has gone missing from a wallet in the room next door and I have to find out whether or not it was you who took it". After several introductory questions, the actual interview commenced. Participants were asked to explain in as much detail as possible what happened when they played Connect 4:

"Please tell me, in as much detail as possible, what happened when you were in the room with Sam just now? Mention all details, all conversations that took place, and give as much information as you can about everyone who entered the room, however irrelevant it may seem. I will only be asking this one question. You will have this one opportunity to give me as much information as you can

possibly remember. Therefore, please tell me as much as you possibly can as I will use all the information you give me to decide whether or not I think you are telling me the truth."

In addition, the 20 liars and 20 truth tellers in the Eye Contact condition were instructed to maintain eye contact with the interviewer: "**As you tell me your answer I need you to maintain constant eye contact with me. Try not to break eye contact at any point. If you do I will remind you to keep eye contact."** No extra instruction was given to the 20 liars and 20 truth tellers in the control condition.

After the interview the police officer gave each participant a questionnaire, which he or she completed in another room. **Participants were asked several manipulation checks. First, they were asked** (i) to what extent they were motivated to appear convincing during the interview, (ii) what they thought the likelihood was of getting the £10, and (iii) what they thought the likelihood was of being made to write a statement. Answers were given on Likert scales ranging from (1) definitely not to (7) definitely (motivation manipulation check) and from (1) very unlikely to (7) very likely (incentive and penalty manipulation checks). To ensure that all participants were paid the same amount (£10), the experimenter told each of them that the police officer had been convinced by their story. **Second, we measured the self-reported experienced emotions and cognitive load. Experiencing emotions was measured with three items: (i) During the interview I was physically aroused (for instance an increased heart rate); (ii) During the interview I felt guilty (for instance about engaging in deception); and (iii) During the interview I was anxious (about not being believed). Answers were given on Likert scales ranging from (1) certainly not to (7) certainly. These three items were clustered into one "emotion" index (Cronbach's alpha = .70). Experiencing cognitive load was also measured with three items: (i) The**

interview required a lot of thinking (cognitive effort); (ii) The interview was (mentally) difficult, and (iii) During the interview I had to concentrate a lot. Answers were given on Likert scales ranging from (1) certainly not to (7) certainly. These three items were clustered into one "emotion" index (Cronbach's alpha = .82).

Verbal and Nonverbal Coding

The interviews were videotaped and transcribed, and these transcripts were the basis for all verbal coding. We had previously trained two people to code visual cues, auditory cues, spatial cues, temporal cues, cognitive operations, and non-chronological productions. The two raters individually coded the statements from the present study. They were both blind to the hypotheses under investigation, to the staged event, and to the experimental condition. One rater coded all the statements and a second rater coded a random sample of 40 statements (50% of the total). The two raters coded per interview the frequency of occurrence of visual details (e.g., "He walked over to the whiteboard" contains three visual details); auditory details (e.g., "She said to sit down" contains one auditory detail); temporal details (e.g., "We started playing" is one temporal detail); spatial details (e.g., "And then the pieces fell on to the floor" contains one spatial detail); cognitive operations (e.g., "She seemed quite clever" contains one cognitive operation)[ii]; and non-chronological production (the number of times the order of event in the narrative differed from the chronological order of the event, typically indicated by the participant saying "Before that…", "Prior to that…"). The frequency scores of the two raters correlated highly with each other for each of the verbal cues **(Spearman correlations, visual details, *r* =. 90; auditory details, *r* = .93; temporal details, *r* = .83; spatial details, *r* = .79; cognitive operations, *r* = .84; and non-chronological production, *r* = .90).**

Coding of vocal cues and all visual cues occurred on the basis of the videotapes, except for the coding of speech hesitations and speech errors which occurred on the basis of the transcripts. We had used these coding schemes in numerous experiments, including Akehurst and Vrij (1999); Caso, Vrij, Mann, and DeLeo (2006); Mann, Vrij, and Bull (2002); Vrij (1995, 2006); Vrij, Akehurst, and Morris (1997); Vrij, Akehurst, Soukara, and Bull (2004); Vrij, Semin, and Bull (1996); Vrij, Edward, and Bull (2001a, b); Vrij, Edward, Roberts, and Bull (2000); Vrij and Mann (2001); Vrij, Mann, Fisher, Leal, Milne, and Bull (2007), and Vrij and Winkel (1991, 1992). Another two raters individually coded the videotapes. These raters were also blind to the hypotheses under investigation, to the staged event, and to the experimental condition. One rater coded all the transcripts/videotapes and a second rater coded a random sample of 8 transcripts/statements (10% of the total). The following cues were coded: pauses (a noticeable pause of a second or more in the interviewee's monologue, $r = .84$); speech hesitations (frequency of saying 'ah' or 'mm' between words, $\underline{r} = 1.00$); speech errors (frequency of word or sentence repetition, sentence change, sentence incompletion, and slips of the tongue, $\underline{r} = .92$); illustrators (frequency of arm and hand movements which were designed to modify and supplement what was being said, $r = .99$); hand and finger movements (frequency of movements of the hands or fingers without moving the arms, $r = .93$); eye blinks (where the eye shuts briefly but completely for a blink, $r = .99$); leg and foot movements (frequency of movements of feet or legs. Simultaneous movements of feet and legs were scored as one movement, $r = .97$); gaze aversion (number of seconds for which the participant looked away from the interviewer, $r = .99$). Speech rate was defined as the number of words (calculated with the word count in Word) divided by length of answer in seconds. All visual and vocal cues except speech hesitations and speech errors were adjusted for the duration of the interview and were

calculated per minute of interview. Speech hesitations and speech errors were calculated per 100 words.[iii]

The average length of the interviews was M = 117.41 seconds (SD = 61.0). To examine differences in length of interview as a function of the experimental manipulations a 2 (Veracity) X 2 (Eye Contact) ANOVA was carried out. None of the main or interaction effects were significant, all F's < 3.32, all p's > .07.[iv]

Results

Manipulation Checks

Six 2 (Veracity) X 2 (Order) ANOVAs were conducted with the six manipulation checks as the dependent variables. The ANOVA regarding maintaining eye contact revealed one significant effect, a main effect for Eye Contact, $F(1, 76)$ = 60.08, p < .01, eta^2 = .44, d = 1.77. Participants in the Eye Contact condition maintained more eye contact (M = 48.58 **seconds**, SD = 8.26) than participants in the control condition (M = 31.28 **seconds**, SD = 11.34). The individual results revealed that in the Eye Contact condition, 20 participants (11 liars and nine truth tellers) out of 40 participants (50%) maintained eye contact for more than 50 seconds per minute, whereas only two out of 40 participants (5%) in the control condition kept eye contact for more than 50 seconds per minute. However, individual results further showed that in the Eye Contact condition, nobody maintained eye contact with the interviewer all the time, although one participant got close (M = 59.15). The Veracity main effect and the Veracity X Eye Contact interaction effects were not significant, both F's < .89, both p's > .35.

The experimental manipulations did not affect the participants' motivation (all F's < 1.32, all p's > .25). The vast majority of participants (79%) reported that they were

motivated to appear convincing during the interview (a score of 5 or higher on the 7-point scale).

The ANOVA regarding the likelihood of receiving an incentive of £10 resulted in main effects for Veracity, $F(1, 76) = 13.31$, $p < .01$, $eta^2 = .15$, $d = .83$. Truth tellers were more convinced that they would receive the incentive ($M = 5.30$, $SD = 1.4$) than liars ($M = 3.98$, $SD = 1.8$). Those results suggest that truth tellers thought that they performed better than liars. The Eye Contact main effect and Veracity X Eye Contact interaction effects were not significant, both $F's < .24$, both $p's > .63$

The ANOVA regarding receiving a penalty (writing a statement) did not reveal any significant main or interaction effects, all $F's < 1.70$, all $p's > .19$. In summary, the participants were motivated to be convincing, and truth tellers thought that they performed better than liars.

The ANOVA regarding experiencing emotions resulted in a Veracity main effect, $F(1, 76) = 20.56$, $p < .01$, $eta^2 = .21$, $d = 1.15$. Liars reported having experienced stronger emotions ($M = 5.06$, $SD = 1.4$) than truth tellers ($M = 3.45$, $SD = 1.4$). The Eye Contact main effect and Veracity X Eye Contact interaction effect were not significant, both $F's < 1.86$, both $p's > .17$.

The ANOVA regarding experiencing cognitive load revealed a Veracity main effect, $F(1, 76) = 19.10$, $p < .01$, $eta^2 = .20$, $d = .98$. Liars reported having experienced more cognitive load ($M = 5.23$, $SD = 1.2$) than did truth tellers ($M = 3.91$, $SD = 1.5$). Neither the Eye Contact main effect nor Veracity X Eye Contact interaction effect were significant, both $F's < .83$, both $p's > .36$. The absence of an Eye Contact main effect or Veracity X Eye Contact interaction effect cast some doubts on (a) the strength of the effect or (b) the participant's awareness of the effect. (See the Discussion.)

Hypotheses-Testing

A 2 (Veracity) X 2 (Eye Contact) MANOVA was conducted with the 14 verbal, vocal and visual cues as dependent variables. The Eye Contact main effect, $F(14, 63) = 8.18$, $p < .01$, $eta^2 = .65$, and Veracity X Eye Contact interaction effect, $F(14, 63) = 2.64$, $p < .01$, $eta^2 = .37$ were significant, whereas the Veracity main effect was **marginally significant**, $F(14, 63) = 1.75$, $p = .068$.

At a univariate level, the Eye Contact main effect revealed six significant findings (see Table 1). Maintaining eye contact resulted in fewer auditory and temporal details, in **fewer** speech hesitations, slower speech, and more eye blinks and hand/finger movements.

At a univariate level, the Veracity X Eye Contact interaction effect revealed significant effects for auditory details, $F(1, 76) = 4.89$, $p < .05$, $eta^2 = .06$; spatial details, $F(1, 76) = 5.49$, $p < .05$, $eta^2 = .07$; and eye blinks, $F(1, 76) = 4.41$, $p < .05$, $eta^2 = .06$. A marginally significant effect emerged for non-chronological production, $F(1, 76) = 3.60$, $p < .062$, $eta^2 = .05$.

Table 2 depicts the findings for the Eye Contact and control conditions separately. In the maintaining Eye Contact condition, liars mentioned fewer spatial details and had a more chronologically structured recall than truth tellers, whereas no differences emerged in the control condition. **For information only, we report in Table 2b the result for the marginal Veracity main effect, by presenting the statistical information regarding this Veracity effect for the ten dependent variables that did not reveal significant interaction effects.**

Discussion

The instruction to maintain eye contact resulted in increased cognitive load **for some but not all of the measures.** Compared to the control condition, the

participants in the Eye Contact condition mentioned fewer auditory and temporal details and spoke slower. The instruction, however, also led to increased eye blinks and hand/finger movements. **An *increase* in such measures are signs of tenseness rather than cognitive load (a decrease would be a sign of cognitive load)**. In other words, the instruction to maintain eye contact may have increased both cognitive load and nervousness.

We were mainly interested in the differences between liars and truth tellers in the Eye Contact and control condition. The findings partially supported the prediction that liars would display more signs of cognitive load than truth tellers, particularly in the Eye Contact condition. Two verbal differences between liars and truth tellers emerged in the Eye Contact condition that did not emerge in the control condition: Liars included fewer spatial details into their account than truth tellers and told their story in more chronological order.

Of the many variables examined, only two significant differences between liars and truth tellers in the Eye Contact condition. These results may be seen as not providing strong support for our hypothesis. We believe that at least three factors may have contributed to **this pattern of results**. **First, the results must be interpreted within the context of the literature on discriminating between liars and truth tellers: This has proven to be extremely difficult. The DePaulo et al. (2003) meta-analysis reveals effect sizes of around *d* = .25 even for the strongest indicators of deceit, and such effects are considered weak**. Second, we told our liars in some detail what the truth tellers had experienced during the staged event. This extensive coaching of liars may have made the task of lying somewhat easier for them, and this may explain why many signs of cognitive load did not emerge. **This explanation is in line with Sporer and Schwandt (2006). They have introduced a**

working memory model to explain differences between liars and truth tellers, a model that is related to our cognitive load approach. They reported that their model fares best when there is little opportunity for preparation and planning. Second, although participants in the Eye Contact condition kept considerably more eye contact with the interviewer than participants in the control condition, not a single participant fully complied with the request to maintain full eye contact consistently. In that respect, the manipulation was not completely successful and that may have weakened the findings.[v] **Third, in apparent contrast to what has been suggested by Doherty-Sneddon et al. (2002, 2005) and Glenberg et al. (1998), our participants may have found that maintaining eye contact was not cognitively demanding. Maintaining eye contact is something people regularly do, for example, when attempting to persuade others (Kleinke, 1986). Practice may reduce cognitive load. A combination of these three explanations may explain why participants in the Eye Contact condition did not report more cognitive load than the participants in the control condition. However, one could argue whether such self-reported findings of cognitive load is valid. Scholars have raised doubts about the sensitivity of such measures and it may therefore be possible that a small increase in cognitive load as a result of the request to maintain eye contact did not become apparent via such self-reported measure. It is well known that people are often not aware of factors that influence them (Nisbett & Wilson, 1977).** To be sure, we cannot explain why the differences between liars and truth tellers did not show up for several measures. However, the findings of this experiment are parallel to what was found in another study where cognitive demand was raised on interviewees (Vrij, Mann, Fisher, et al.'s, 2007, reverse order study). The replication of findings in two parallel studies strengthens the notion that increased cognitive

demand on suspects makes it more likely that cues to deception will occur.

The real concern is whether observers can discriminate between liars and truth tellers more effectively when stories are told while maintaining eye contact. Experiment 2 addressed this issue.

EXPERIMENT 2

The Eye Contact condition revealed that liars provided fewer details than truth tellers whereas the control condition did not reveal such differences. Nevertheless, this does not automatically imply that observers will be able to discriminate better between truth tellers and liars in interviews where interviewees maintain eye contact. Successful discrimination depends on whether observers interpret the diagnostic cues correctly. Lack of detail creates the impression of suspicion (Strömwall, Granhag & Hartwig, 2004; Taylor & Hick, 2007; Vrij, Akehurst, & Knight, 2006). Therefore, we were hopeful that observers could differentiate between truths and lies more in the Eye Contact condition. However, rather than relying on details, observers typically rely heavily on eye contact when making veracity judgements and associate gaze aversion with deception (Strömwall et al, 2004; The Global Deception Team, 2004; Vrij, Akehurst, & Knight, 2006). Although we informed observers that the target persons they were going to observe had been asked to maintain eye contact (see below) we cannot rule out that the observers would still rely on eye movements to detect deception. A well-documented error in social perception is the tendency to overlook the impact of a situation on a person's responses (the *fundamental attribution error*, Ross, 1977). In a lie detection context, observers may still rely on eye contact when making veracity judgements, despite having been informed that the target persons were requested to maintain eye contact. This could impair ability to discriminate between truths and lies. In fact, it could result in many target persons

being judged as truthful in the Eye Contact condition (i.e., truth-bias) and this would result in a high accuracy rate in detecting truths and a low accuracy rate in detecting lies. Therefore, in addition to a group of observers who could see and hear the target persons, we also included in our experiment a group of observers who could only hear the target persons.

Method

Participants

The participants were 44 male and 62 female undergraduate students. Their average age was M = 19.94 years (SD = 2.5). When asked to indicate on a 5-point Likert scale how motivated they were to perform well on the task, 79% reported themselves as fairly or highly motivated (a score of 4 or 5 on the 5-point Likert scale, M = 3.85, SD = .72).

Procedure

The experiment took place at a Students' Union in a British University. Between seven and fifteen participants were tested simultaneously. The number did not in any way affect the conduct of the experiment. The experiment took place in a large classroom that would have enabled twenty participants to have seen the screen clearly (or listen to the CD clearly as appropriate), sitting far enough apart so as not to see each other's answers. Participants were given questionnaires and asked to complete the first section relating to background details and their motivation to perform well. They were then informed that they were about to see/hear a selection of clips of students who were either lying or telling the truth about a scenario that involved the theft of money from a wallet. The scenario involved their playing a game of Connect 4 with another participant (actually a stooge) whilst various people entered or exited the room**. Truth tellers had actually participated in this event, and, in**

fact, had not taken any money; liars were given a brief summary of the event that truth tellers had participated in, and then actually took the money from the wallet. The experimenter did not tell the participants how many clips they would see/hear, or what percentage were truths or lies, so as to avoid participants attempting to calculate how many truths and lies they were actually being shown, and hence deliberately trying to achieve a certain number of truth/lie responses. Instead they were informed that although they would not be told how many clips they would see/hear, there would not be as many clips as were in their questionnaire. They were told that after each clip the tape would be stopped, and when everybody had completed all questions on the questionnaire relating to that clip, the next clip would be shown. In the Video + Audio condition (N = 46 lie detectors) the videotaped interviews ('clips') were shown on a large screen (approximately 2m x 1m), in the Audio condition (N = 60 lie detectors) participants listened to the clips via a CD player. Thus, the participants in the Audio condition were exposed to the same clips as the participants in the Video + Audio condition, albeit to the sound channel only.

54 lie detectors (23 in the Video + Audio condition and 31 in the Audio condition) saw/heard 16 interviews with interviewees who were instructed to maintain eye contact with the interviewer, and 52 lie detectors (23 in the in Video + Audio condition and 29 in the Audio condition) saw/heard 16 interviews with interviewees who did not receive an instruction to maintain eye contact. Those 32 interviews were sampled randomly from interviews in Experiment 1. Of the 16 interviews seen/heard by each observer, eight interviewees lied and eight told the truth.

In the Eye Contact condition, prior to watching/listening to the maintaining eye contact interviews the participants were informed that the students that they were

about to see/hear had been instructed to maintain eye contact while describing everything that had happened.

After watching/listening to each clip the observers were asked to answer the following question: Do you think that the suspect is telling …. (dichotomous answer, the truth / a lie). We also asked them: To what extent do you think the suspect is lying? (Answers were given on 7 point Likert scales ranging from (1) definitely not to (7) definitely.) A 7-point Likert scale is more sensitive than a dichotomous scale, so we may capture differences between conditions via the Likert scale that would remain unnoticed via the dichotomous scale. The study took about one hour to conduct.

Accuracy was measured by calculating the percentage of correct veracity judgements given by each participant in judging the truthful clips (truth accuracy) and deceptive clips (lie accuracy).

Results

Dichotomous Answers

The overall detection accuracy (proportion correct) in the experiment was *M* = .53 (*SD* = .13), which was significantly above the level of chance *t*(105) = 2.34, *t* < .05. A 2 (Veracity) X 2 (Eye Contact) X 2 (Modality) mixed ANOVA was conducted with Veracity as the within-subjects factor, Eye Contact and Modality as the between-subjects factors, and accuracy as the dependent variable. The analysis revealed a significant Veracity effect, $F(1, 102) = 5.71$, $p < .05$, $eta^2 = .05$, and a significant Veracity X Eye Contact X Modality interaction effect, $F(1, 102) = 5.24$, $p < .05$, $eta^2 = .05$. None of the other main effects or interaction effects were significant, all F's < 1.41, all p's > .24. **The Veracity main effect reveals that truths (*M* = .56, *SD* = .18) were more accurately detected than lies (*M* = .50, *SD* = .19). The truth accuracy rate was significantly above the level of chance, *t*(105) = 3.42, *p* < .01,**

whereas the lie accuracy rate did not differ from chance, *t*(105) = -.13, *ns*. Of the two significant effects, the three-way interaction effect is the most informative and only this effect will be discussed. Table 3 gives the results for the eight individual cells and for the relevant statistical comparisons between these cells. It reveals one significant effect: In the Audio condition, lie accuracy was significantly higher in the Eye Contact condition than in the control condition. The lie accuracy score in the control condition (44%) was significantly below the level of chance, $t(28) = 2.06$, $p < .05$, whereas the lie accuracy rate in the Eye Contact condition (53%) did not differ from chance, $t(30) = 1.07$, *ns*.

Likert Scale Answers

A 2 (Veracity) X 2 (Eye Contact) X 2 (Modality) mixed ANOVA was conducted with Veracity as the within-subjects factor, Eye Contact and Modality as the between-subjects factors, and the Likert scale answers as the dependent variable. The only significant effect that emerged was for Veracity, $F(1, 102)$ 8.17, $p < .01$, $eta^2 = .07$, $d = .35$. The lying interviewees were perceived more as lying ($M = 4.08$, $SD = .76$) than the truth telling interviewees ($M = 3.82$, $SD = .72$). No other main or interaction effects were significant (all $F's < 2.44$, all $p's > .12$). Despite the absence of significant interaction effects, a more detailed analysis of the data is relevant and justifiable for the purpose of hypothesis-testing. Those analyses revealed that the significant Veracity effect discussed above was due to the Eye Contact condition. Only in the Eye Contact condition were the lying interviewees perceived as lying more than the truthful interviewees (see Table 4).

Judgements of Target Persons Who Maintained Eye Contact

The amount of eye contact the target persons maintained with the interviewer varied in the Eye Contact condition. Eight interviewees (five liars and three truth

tellers) maintained eye contact for more than 50 seconds per minute with the interviewer, and were thus relatively successful in complying with the instruction to keep eye contact. In those eight interviewees, in the Video + Audio condition the lie accuracy rate (M = .38, SD = .23) was significantly below the level of chance, $t(22)$ = 2.42, $p < .05$, whereas the truth accuracy rate (M = .67, SD = .28) was significantly above the level or chance, $t(22)$ = 2.81, $p < .01$. **A signal detection theory analysis showed a truth bias with *B"* (M = .46, SD = .55) being significantly above the level of chance, $t(22) = 3.94$, $p < .01$.** This reflects the previously described truth-bias and Fundamental Attribution Error. In the Audio condition the lie accuracy score (M = .50, SD = .19) was equal to chance, whereas the truth accuracy score (M = .61, SD = .26) was significantly above chance, $t(30)$ = 2.42, $p < .05$. **The *B"* value (M = .17, SD = .60) did not differ from chance, t(30) = 1.56, *ns*.**

Despite the truth-bias, observers were still capable of differentiating between truths and lies via their Likert scale judgements. Of those eight interviewees who kept eye contact with the interviewer, the liars were perceived more as lying than the truth tellers in both the Video + Audio condition, (liars: M = 3.91 (SD = 1.1); truth tellers: M = 3.36 (SD = 1.0), F(1, 22) = 2.94, $p < .10$, two-tailed, eta^2 = .12, d = .52), and Audio condition (liars: M = 4.08 (SD = .7); truth tellers: M = 3.61 (SD = 1.1), F(1, 30) = 6.94, $p < .05$, eta^2 = .19, d = .52).

Discussion

Experiment 2 demonstrated that instructing participants to maintain eye contact facilitates lie detection. Only in the eye contact maintenance interviews could the observers distinguish truths from lies. We acknowledge that even in the Eye Contact condition the ability to distinguish truths from lies was not impressive. However, one should take into account that we told our liars (see Experiment 1) in

detail what truth tellers had actually experienced during the staged event, which may make lie detection more difficult than in situations where liars have to invent all the details themselves. It is not the absolute level of performance itself that matters, but the difference in performance between experimental conditions. Our results demonstrate that the instruction to maintain eye contact increased the ability to distinguish between truths and lies from chance level (control condition) to above chance level (Eye Contact condition). This is in qualitative terms an important improvement.

We raised concern that the instruction to maintain eye contact could be interpreted incorrectly by observers and could result in a tendency to believe the target person (i.e., truth-bias) in the Video + Audio condition. We found evidence that this indeed occurred when judging the target persons who complied well with the request to maintain eye contact. However, importantly, even in these target persons lie detectors could discriminate between liars and truth tellers, and the liars made a somewhat more suspicious impression than truth tellers. **An easy way to avoid any possible side-effects of the eyes-instruction is by providing a non-visual record of the interview to observers –as is the Audio condition of the present experiment.**

General Discussion

In this article we tested the hypothesis that imposing cognitive load on interviewees facilitates lie detection. We imposed cognitive load in the experimental condition by instructing interviewees to maintain eye contact with the interviewer. We predicted that the instruction to maintain eye contact would be particularly debilitating for liars, because their cognitive resources have already been partially depleted by the cognitively demanding task of lying. This would result in more cues to deceit between liars and truth tellers, and, hence, more opportunity to differentiate

between them, when liars and truth tellers are requested to maintain eye contact compared to a control condition. Indeed, the interviews in which participants were instructed to maintain eye contact contained more cues to deceit than the control interviews, and the instruction to maintain eye contact improved students' ability to detect deception.

We are not the first researchers to argue that lying can be cognitively more demanding than truth telling. The idea originated in the seminal paper written by Zuckerman et al. (1981) and has been promoted since. Researchers differ somewhat in their reasoning as to why lying is more cognitively demanding and, accordingly, have examined different cues to cognitive load. For example, in their Activation – Decision – Construction – Model of lying, Walczyk and colleagues emphasise two aspects of lying to be cognitively demanding: The decision to lie and the construction of the lie. They tested their model in a reaction time task and found that, in support of the model, liars responded significantly slower than truth tellers (Walczyk et al., 2003, 2005). Sporer and Schwandt (2006, 2007) presented a working memory model of lying that is broader than Walczyk's model. For example, apart from reconstruction of the lie, their model includes that liars will attempt to regulate their behaviour. They reported that liars' tendency to decrease their hand, foot and leg movements support this latter part of their model (Sporer & Schwandt, 2007). Sporer and Schwandt (2006) also mentioned an important restriction to their model: They argued that it fares best when there is little opportunity for planning. Our six reasons why lying is cognitively more demanding than truth telling, presented in the Introduction, cover the aspects of lying emphasised by Walczyk et al. and Sporer et al. . With Sporer et al., we argued in the Discussion of Experiment 1,

that extensive planning by liars may affect the differences between liars and truth tellers.

As opposed to other researchers, who have suggested measuring cognitive load as a means to discriminate between liars and truth tellers, we argue here that interviewers can exploit the differences in cognitive load between liars and truth tellers, thereby magnifying the differences between the two, and ultimately to facilitate lie detection. Such a proactive approach to improving law enforcement investigators mirrors other advances in the field (e.g., the Cognitive Interview, Fisher & Geiselman, 1992; lineup instructions, Wells, Small, Penrod, Malpass, Fulero, & Brimacombe, 1998) and reflects a healthier solution than relying exclusively on after-the-fact measurements (e.g., Fisher & Reardon, 2008; Wells, 1978). Our approach to lie detection is not restricted to asking interviewees to maintain eye contact or, as we demonstrated in a previous experiment, asking interviewees to recall their stories in reverse order. Numerous other methods to make the interview setting cognitively more challenging should have a similar effect. We hope that our work inspires researchers to further develop the cognitively based lie detection method introduced in this article.

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Endnotes

[i] Connect 4 is a popular two-player game where players drop counters into a slotted grid to achieve, and simultaneously prevent their opponent from achieving, four of their counters in a row.

[ii] **Originally in RM, the cognitive operations criterion refers to descriptions of inferences made by the participant at the time of the event. In our research, however, we use a wider definition and also include descriptions of inferences made by the participant when describing the event at a later time.**

[iii] We did not calculate the verbal cues per minute of speech because we believe that this changes the nature of the verbal cues. That is, the number of details mentioned in a statement is different from the number of details mentioned per 100 words, because the latter refers to the conciseness of presenting information whereas the former does not. When we included the duration of answer as a covariate in our analysis, the results for the verbal cues showed the same pattern as presented in the main text.

[iv] **Truthful accounts (M = 116.5, SD = 68.3) were similar in length to deceptive accounts (M = 118.3, SD = 53.7), $F(1, 76) = .02$, $eta^2 = .00$.**

[v] The level of compliance with the maintaining eye contact instruction did not differ between liars and truth tellers. This finding is worth mentioning. Investigators often treat a failure to comply with an instruction with suspicion (Vrij, 2008). However, this experiment showed that a failure to follow the instruction to keep eye contact cannot

be seen as a sign of deceit.

Table 1

Verbal, Vocal and Nonverbal Cues as a Function of Eye Contact: Significant Findings

	Eye Contact		Control		F(1, 76)	eta^2	d
	M	SD	M	SD			
Auditory details	5.55	3.0	7.55	4.4	6.03*	.07	.54
Temporal details	6.02	3.4	8.40	4.1	8.15**	.10	.64
Hesitations	2.75	2.2	4.17	2.1	8.94**	.11	.66
Speech rate	125.90	31.1	166.16	27.2	38.24**	.34	1.38
Eye blinks	26.83	12.3	20.68	11.7	5.41*	.07	.51
Hand/finger movements	24.02	18.9	8.83	7.8	23.58**	.24	1.14

* $p < .05$ ** $p < .01$

Table 3

Truth and Lie Accuracy Scores as a Function of Eye Contact and Modality

	Eye Contact		Control		F(1, 44)	eta^2	d
Video+Audio	M	SD	M	SD			
Lie accuracy	.47	.20	.55	.22	1.80	.04	.38
Truth accuracy	.59	.19	.54	.19	.61	.01	.26
Audio						F(1, 58)	
Lie Accuracy	.53	.17	.44	.17	4.97*	.08	.53
Truth Accuracy	.55	.17	.56	.19	.12	.00	.06

* $p < .05$ ** $p < .01$

Table 4

Truth and Lie Likert Scores as a Function of Eye Contact and Modality

	Lie Likert Score		Truth Likert Score		F	df	eta^2	d
Video+Audio	M	SD	M	SD				
Eye Contact	4.10	.81	3.66	.72	4.97**	1, 22	.18	.57
Control	4.09	.95	3.88	.72	1.22	1,22	.05	.25
Audio								
Eye Contact	4.24	.70	3.93	.69	3.26*	1,30	.10	.44
Control	3.89	.61	3.80	.75	.28	1,28	.01	.13

** $p < .05$, two-tailed test * $p < .05$, one-tailed test

Table 2a.

Verbal, Vocal and Visual Cues as a Function of Veracity and Eye Contact: Significant Interaction Findings

	Eye Contact							Control						
	Truth		Lie					Truth		Lie				
	M	SD	M	SD	F(1, 38)	eta^2	d	M	SD	M	SD	F(1, 38)	eta^2	d
Auditory details	6.05	3.0	5.05	2.9	1.15	.03	.34	6.25	4.2	8.85	4.2	3.80	.09	.62
Spatial details	6.95	3.5	4.75	2.7	4.96*	.12	.71	5.25	3.2	6.25	2.7	1.12	.03	.34
Non-chronological production	.3	.5	.05	.2	4.61*	.11	.71	.10	.3	.15	.4	.22	.01	.14
Eye blinks	29.73	13.8	23.93	10.0	2.30	.06	.49	18.03	8.8	23.34	13.8	2.11	.05	.47

- $p < .05$

Table 2b.

Verbal, Vocal and Visual Cues as a Function of Veracity: Remaining Variables

	Truth		Lie				
	M	SD	M	SD	F(1, 76)	eta^2	d
Visual details	31.20	15.1	28.13	9.3	1.19	.02	.25
Temporal details	7.68	4.1	6.75	3.7	1.24	.02	.24

Cognitive operations	1.88	3.0	2.80	2.8	2.01	.03	.32
Pauses	7.33	3.2	5.86	4.1	3.24	.04	.40
Speech hesitations	3.88	2.3	3.05	2.2	3.06	.04	.37
Speech errors	1.58	1.3	1.28	1.0	1.33	.02	.26
Illustrators	28.47	27.3	23.58	16.1	.98	.01	.22
Hand and finger movements	20.69	17.3	12.16	14.2	7.42**	.09	.54
Leg and foot movements	12.53	19.7	7.58	11.7	1.89	.02	.32
Speech rate	141.16	34.1	150.90	36.5	2.24	.03	.28

Endnotes