Lie-detection by strategy manipulation: Developing an Asymmetric Information Management (AIM) technique.

Abstract

Liars can, when prompted, provide detailed statements. Ideally, interview protocols to improve lie-detection should (a) encourage forthcoming verbal strategies for truth tellers and (b) encourage withholding verbal strategies for liars. Previous research has investigated (a) but not (b). We designed an Asymmetric Information Management (AIM) instruction - informing interviewees, *inter alia*, that more detailed statements are easier to accurately classify as genuine or fabricated - to encourage truth tellers to be verbally forthcoming *and* to encourage liars to be verbally withholding. Truth tellers (n = 52) and liars (n = 52) took part in one of two counterbalanced missions, and were assigned to either the AIM or control interviewing condition. Truth tellers provided (and liars withheld) more information in the AIM condition (compared to the control condition), and thus, discriminant analysis classificatory performance was improved. Therefore, a simple instruction can simultaneously modify the respective strategies of liars and truth tellers.

Keywords: AIM technique, deception, lie-detection, information elicitation, forensic interviewing.

General Audience Summary

Interview protocols designed to improve lie-detection should *both* (a) encourage truth tellers to adopt forthcoming verbal strategies and, (b) encourage liars to adopt withholding verbal strategies. Research shows liars can, when prompted to disclose detailed statements, provide as much detailed information as truth tellers. Previous research in the 'encouraging interviewees to say more' literature has investigated (a) but not (b). We propose a new technique designed to achieve both. That is to elicit information from truthful (but not deceptive) suspects. This is achieved by providing all suspects with an instruction informing them that detailed statements are easier to classify as genuine or fabricated. This instruction creates an 'Asymmetric Information Management' (AIM) dilemma that can only be solved by truth tellers and liars adopting different verbal strategies during the interview. We extend previous literature by designing an instruction to encourage truth tellers to be verbally forthcoming *and* to encourage liars to be verbally withholding. Firstly, truth tellers (n = 52) and liars (n = 52) took part in one of two counterbalanced missions, to ensure that the task locations were similar in difficulty. Next, they were assigned to either the AIM condition, or a control condition (where a standard free recall instruction was used). As predicted, truth tellers provided more information in the AIM condition compared to a control condition. Liars withheld more information in the AIM condition compared to the control condition. Lie-detection accuracy was enhanced due to this effect. Theoretically, this suggests that instructions can be designed to target the respective strategies of liars and truth tellers. In practical terms these instructions are easy for investigators to implement, without any prior judgement on whether the individual is likely to be truthful or deceptive.

Refining information elicitation as a lie detection technique: Developing an Asymmetric Information Management (AIM) technique.

For effective investigative or information gathering interviewing to take place, the investigator must elicit information from eyewitnesses and potential suspects (Bull, 2010; Fisher, 2010). To do this they must gather information, while trying to assess the credibility of the interviewee's statement. As such, gathering information should be the primary intention, with detecting deceit as a secondary, yet important objective. In order to do this, new tools, techniques and approaches should ensure greater information elicitation from truth tellers, without also prompting liars to make such a detailed recall. If liars are also prompted to be more detailed, then comparing truthful and deceptive statements based on the quantity of detail (*see* Ewens et al., 2016), or by using specific veracity tool such as Criteria-Based Content Analysis (CBCA) (*see* Bogaard et al., 2014; Leal, Vrij, Warmelink, Vernham, & Fisher, 2015) becomes difficult. Although it is true that both the quality and quantity of information is important for forensic interviewing, in the following study we focus exclusively on the amount of information elicited. This study investigates a new interviewing technique which focuses upon creating an information management dilemma that is different for truth tellers and liars. This is known as the Asymmetric Information Management (AIM) technique.

Information eliciting literature

Lie-detection research predicts that truth tellers and liars should behave differently when interviewed using information elicitation techniques (e.g. Vrij, Fisher, & Blank, 2017; Colwell, Hiscock, Anisman, Memon, Taylor, & Prewett, 2007; Colwell, Hiscock & Memon, 2002). The rationale for this prediction comes from the different mental states that truth

tellers and liars may have during an interview. Truth tellers should be able to freely disclose information they can retrieve from memory and report, thus adopting a forthcoming strategy (Hartwig, Granhag, & Strömwall, 2007; Hartwig, Granhag, Strömwall & Doering, 2010). In contrast, liars are predicted to behave differently based upon a number of influential factors. Firstly, some researchers argue that liars must successfully manipulate the information they disclose to maintain their fabrication (Colwell et al., 2007; McCornack, 1992; McCornack, Levine, Solowczuk, Torres, & Campbell, 1992). One explanation for this is because liars are strategically *unwilling* to provide highly detailed statements due to fears of reporting information that provides investigators opportunities to falsify their statement (Nahari, Vrij, & Fisher, 2014a; 2014b). Alternatively, liars may be *unable* to fabricate such detailed information due to the increased cognitive burden that can be associated with lying, together with the limited processing capacity of working memory (e.g. Vrij, Fisher, Mann, Leal, 2006; Blandón-Gitlin, Fenn, Masip, & Yoo, 2014; Walczyk, Igou, Dixon, & Tcholakian, 2013), or due to lacking the imagination to falsify such information (Köhnken, 1989; 2004).

Unfortunately, empirical research has provided mixed support for the above predictions. In some contexts, liars can report detailed statements, for example when prompted to be more detailed via tools such as a Model Statement (Bogaard et al., 2014; Ewens et al., 2016; Harvey et al., 2017a; Leal et al., 2015; Vrij, et al., 2017; Kleinberg et al., 2017; but also see Brackmann et al., 2017). As a result, statements from truth tellers and liars appear highly similar making it hard to distinguish between them.

The AIM technique

If liars have the ability to report detailed statements when prompted, then an alternative, and arguably more effective, approach is to develop an interviewing instruction that *reduces liars' willingness to be detailed* whist simultaneously *encouraging truth tellers to report*

more information. In other words, the strategic differences (with respect to information manipulation) between truth tellers and liars should not just be used as a basis for credibility assessment (as is the case in the encouraging interviewees to say more literature: e.g. Bogaard et al., 2014; Ewens et al., 2016; Leal et al, 2015). Rather, such strategic differences should be *proactively exaggerated* by a credibility assessment tool. As the content of verbal statements is influenced by the mental strategies interviewees adopt, encouraging honest and dishonest respondents to use diverging strategies should maximise reporting differences, compared to exclusively targeting (and magnifying) the strategies of *either* truth tellers' *or* liars'.

The goal of the pre-retrieval AIM technique is to establish an information management dilemma for truth tellers and liars that has different, veracity-dependent, solutions. In the deception literature, an information management dilemma refers to a situation (usually established via an interviewing instruction) whereby the information presented to the interviewees leads to a conflict of motivations (the dilemma), usually for the liar, about what information to report during the subsequent interview. This manipulation of interviewee's mental strategies causes the verbal behaviour of truth tellers and liars to *diverge*, enhancing available cues to deception. By focusing on the different verbal strategies adopted by liars and truth tellers in response to an information management dilemma, the AIM technique is conceptually similar to the informing manipulation used with the Verifiability Approach (VA; Nahari, Vrij, Fisher, 2014b). On a conceptual level, the AIM technique and VA are similar in that they both inform interviewees of the relationship between credibility and information reported. Previous research has shown that interviewees can regulate their memory outputs (Ackerman, & Goldsmith, 2008; Fisher, 1996), especially when provided with specific information by the interviewer (Koria, & Goldsmith, 1996), which can result in the elicitation of additional cues to deception (Nahari et al, 2014b).

The AIM and VA techniques also have important differences. In the VA, providing participants with the information protocol (an instruction informing interviewees of the importance of reporting verifiable information) amplifies the use of asymmetric information management strategies by both truth tellers and liars (Harvey et al, 2017a; 2017b). Specifically, truth tellers provide more verifiable details whereas liars do not. In contrast, the AIM instruction attempts to disrupt the willingness of liars (but not truth tellers') to report detailed statements. The AIM technique is more general than the VA, and establishes an information management dilemma that encourages liars to withhold information and truth tellers to be forthcoming. The crux of this new technique is to inform interviewees about the conceptual association between a) *reporting detailed statements*, with b) *an increased chance of being accurately judged as truthful or deceptive*. For truth tellers, being accurately judged (i.e. as honest) is rationally beneficial (i.e. being judged as truthful is their objective). Therefore, truth tellers are provided with a reason to adopt forthcoming verbal strategies.

Based upon the above theoretical considerations we predict that truth tellers in the AIM instruction condition will report statements containing significantly more overall detail compared to truth tellers in the control condition (Hypothesis 1). Furthermore, we hypothesise that liars in the AIM instruction condition will report statements containing significantly less overall detail compared to liars in the control condition (Hypothesis 2). Consequently, we hypothesise that accurate discrimination between truth tellers and liars will be enhanced in the AIM condition, compared to the control condition (Hypothesis 3).

Method

Pre-registration

This study was pre-registered (*see* https://osf.io/a76vx).

Design

A 2 (veracity: truth teller vs. liar) x 2 (interviewing condition: Asymmetric Information Management 'AIM' technique vs. control condition) between factors design was used. The control condition contained a standard 'report everything' instruction. Experimental task location was counterbalanced across two locations.

Participants

A total of 104 participants (68 females, 35 males, 1 other) aged between 18 and 38 years (M = 20.64, SD = 5.02, 95% CI [19.67, 21.62]) from the University's undergraduate (n = 93), postgraduate (n = 5) and staff communities (n = 6) took part in this study.

Sample size rationale

A power analysis using G*Power (Faul, Erdfelder, Lang & Buchner, 2007), assuming a medium effect size of f = 0.30 (alpha = 0.05) for four groups, indicated a sample size of 90 would be sufficient for an acceptable power of 0.80 (Cohen, 1992). For tests that examine interaction effects (e.g. the Veracity x Interview type explored in the current study), G*Power tends to provide over-generous power estimates by underestimating the number of required participants to achieve 80% power (for more information, please see https://approachingblog.wordpress.com/2018/01/24/powering-your-interaction-2/). To account for this and to compensate for any potential participant attrition (i.e. participants not following experimental instructions and requiring exclusion), an additional 14 individuals

(approximately 15% of the original G*Power estimate) were recruited (allowing for n = 26 participants per experimental cell).

Procedure

Most participants were recruited via a psychology department participant pool. These participants received partial course credit for taking part. Additional participants were recruited via posters displayed within the psychology department, or via the staff website, allowing individuals to volunteer for the research via email. All participants were informed that they must be at least 18 years old, and must have good spoken English in order to take part in the study, due to the interview requirement.

Individuals arrived at the laboratory at pre-arranged times and were informed that the study involved taking part in a secret mission, whereby they would have to report details about this mission to an intelligence officer. Each participant was given an information sheet about the study and was asked to sign an informed consent form if he/she was happy to take part. After providing informed consent, each participant was randomly assigned to either the truthful or deceptive condition using a pre-registered random allocation grid.

For the purposes of counter-balancing, participants were randomly allocated to one of two missions:

1) For Mission 1, participants (n = 52) were tasked with making an intelligence drop off via email. They were provided with a USB stick, and instructed to go to the university library, to log onto a computer, and to send an email to the experimenter with an encrypted file labelled ‘PROJECT BLACK HORSE’. The briefing for this drop off was that they would not be suspected by any other hostile agents, but that they should remain discreet in case they are spotted.

2) In Mission 2 (n = 52) participants were provided with a room key, and were instructed to retrieve an intelligence file (in the form of a sealed brown envelope) from the building they were in. Next, they were instructed to take the file to a nearby creative arts university building where they were to make a drop off. The briefing for this drop off was that another agent would arrive shortly after them to collect the file, but that they should remain discreet in case they are spotted by any hostile agents.

Upon their return, truth tellers were informed that, in their absence, one of the agents had been involved in a data breach. The data breach involved either 1) confidential information being leaked to an unknown person or persons, which had been linked to the university network, or 2) the brown envelope went missing from the pickup zone. Truth tellers were informed that as they were not with the experimenter during the time of data breach, they are a suspect and so would be interviewed. Their task was to be completely honest during the interview, and to convince the analyst they were being truthful and had nothing to do with the data breach.

Upon their return, liars were informed about the same breach, but as they were on a covert mission and cannot disclose their real whereabouts at the time, they must instead convince the interviewer that they were in the location of the alternative mission, doing a different task. That is, liars who completed Mission 1 lied about their whereabouts using a cover story based upon Mission 2. Alternatively, liars who took part in Mission 2 built a cover story based upon Mission 1.

Liars were instructed to convince the analyst they were being truthful and that they had nothing to do with the data breach. Liars were instructed not to reveal details of their mission and instead to come up with a cover story based on bullet points from the truth teller task indicating (i) details about the secure drop off, (ii) information about the file, (iii) details about

the location, and (iv) the approximate time spent at the location. Liars were allowed to freely add details that could encourage the interviewer to believe them during their preparation time.

More specifically,

- Liars who were sent to the library building (Mission 1) were provided with an outline of a cover story detailing the task involved in the creative arts building (Mission 2).
- Liars who were sent to the creative arts building (Mission 2) were provided with an outline of a cover story detailing the library task (Mission 1).

Pre-interview stage

All participants were offered time to prepare themselves before the interview (*10 minutes maximum*). To help with preparation, participants were offered a pen and paper if they wanted to make notes – though it was explained that notes could not be taken into the interview. A significant difference emerged between accepting preparation time $\chi^2 = (1, n = 104) = 87.75$, $p = <.001$, Cramer's $V = .91$ (which corresponds to a large effect size, Cohen, 1988) with all truth tellers ($n = 52/52$) declining preparation time and the vast majority of liars ($n = 47/52$) accepting preparation time.

Once participants indicated they were prepared they completed a pre-interview questionnaire. This included participant demographics such as age, gender, and motivation levels 'to what extent do you feel motivated to perform well - i.e. appear convincing - during your interview' (*7-point Likert scale '1- not at all' to '7- completely'*), as well as how prepared they felt. Next, all participants were instructed that their task was to convince the interviewer that they were telling the truth, and if they failed to do so then they might have to wait and be interviewed by a second analyst (in reality this would never occur).

After preparation, each participant was taken to a different room to be interviewed by an 'intelligence analyst' (who was blind to veracity conditions and the experimental hypotheses). Each participant was randomly allocated to one of two conditions: (i) a control condition (n = 52), or (ii) the AIM condition (n = 52). In all conditions, the participants were reminded that the interviews would be audio recorded to allow for transcribing.

Interview

The interviewer began with the following introduction, regardless of interviewing condition:

> "As you are aware, sensitive information has gone missing from a routine drop-off mission. I am told that as you were one of the agents active and operating alone in the field at the time of this breach you are suspected of involvement. I do not know if you are involved or not. It is simply my task to collect your statement for analysis by our lie-detection software."

In the AIM condition (n = 52), the AIM instructions were verbally provided.

AIM instructions

First, however, please pay close attention to the following information.

During interviews, individuals frequently over-estimate how easily an analyst can determine if they are being deceptive or honest.

Actually, lie detection is not easy and I cannot take your honesty for granted. However, you can make it easier for us to determine if you are being honest or lying.

This is because our lie detection techniques become *more* accurate and reliable the *more* information you provide.

If you provide a *longer*, *more detailed statement*, we will be better able to classify you as either honest or lying.

In the control condition (n = 52), or after hearing the AIM instructions, one standard free recall question was asked. The interviewer was a male, British, 32 year old postgraduate student. To control for interviewer bias, the same interviewer was used throughout the entire study.

Upon completion of the interview, a post interview questionnaire was provided, which gathered information on motivation levels 'How motivated were you overall to perform well – i.e. provide a convincing statement – during this study' ('7-point Likert scale '1- extremely unmotivated' to '7- extremely motivated); the likelihood of being interviewed by a second analyst' (7-point Likert scale '1- not at all' to '7- completely'); and a rating of truthfulness 'To what extent did you tell the truth during your statement' (percentage scale ranging from 0% to 100%). Finally, participants were asked 'How difficult were the interviewer's instructions to follow' (7-point Likert scale '1- not at all' to '7- very difficult); if they believed the instruction made them report more information (7-point Likert scale '1- not at all' to '7- to a great extent'); if they had prepared a strategy for the interview and, if so to elaborate on this.

At the end of the procedure participants were debriefed, thanked, and invited to ask the experimenter questions.

Coding

The transcribed audio-recorded interviews were used as the basis of all coding. All statements were then rated by one coder (blind to the experimental conditions and hypotheses) who scored the occurrence of overall detail. That is the combined total of: i) spatial detail, ii) temporal detail, iii) perceptual detail, iv) and action detail. Spatial, temporal and perceptual detail are part of the Reality Monitoring framework (see Jonson & Raye, 1981), which is commonly used in the lie-detection literature (Vrij, 2008). Action details (details about

others' or one's own activities) are not included in the Reality Monitoring's coding scheme (Memon, Fraser, Colwell, Odinot, & Mastroberardino, 2010, Vrij, 2008, Vrij, 2015), but depict sensory information that should be included in analysis (for a similar observation see Porter et al., 2017). Spatial details refer to information about locations, or arrangements and/or objects (e.g. "I went *left, towards* the Park, then turned *right* and seen the place I was supposed to be at"), temporal details relate to information about when the event happened or explicit descriptions of the sequence of various events (e.g. "I arrived at the building, around *2pm* and *then* looked for the package"), perceptual details relate to information about what was seen, heard, felt, tasted, and smelt during the described activities (e.g., "I saw a *woman* at the reception area who *spoke* to me"), and action details relate to information that explicitly describes an action or the process of actions performed by the interviewee (e.g., "I *stole* a mobile phone from the building").

Reliability coding

A second coder (also blind to the experimental conditions) coded a random selection of 26 statements (25% of the sample). Inter-rater reliabilities between the two coders for the occurrence frequency of details were measured via intra-class correlation coefficients (ICC). The ICC was high and therefore satisfactory for overall detail [ICC] = .94.

Results

Counterbalancing check (experimental task location). Typically, deception research involves truth tellers and liars performing difference tasks. To ensure any veracity differences could not be attributed to the completion of different tasks, we counterbalanced this factor. A 2 (veracity: truth teller vs. liar) x 2 (experimental task location: library vs. creative arts building) between-subjects ANOVA was conducted to examine the effect of

experimental task location. A main effect emerged for veracity, $F(1, 100) = 17.85$, $p < .001$, $d = 0.82$, 95% CI [0.41, 1.21]), with truth tellers reporting more information ($M = 64.58$, $SD = 46.17$, 95% CI [54,78. 74.37]) than liars ($M = 35.08$, $SD = 21.49$, 95% CI [25.28, 44.87]). A main effect of task location emerged, $F(1, 100) = 4.09$, $p = .046$, $d = 0.37$, 95% CI [0.02, 0.75]) with more information being provided by participants who took part in a library task ($M = 56.88$, $SD = 40.45$, 95% CI [47,09, 66.68]), compared to those who were sent to the creative arts location ($M = 42.77$, $SD = 36.05$, 95% CI [32.97, 52.57]). The interaction effect for veracity X interviewing condition was not significant, $F(1, 100) = .23$, $p = .633$, $f = 0.05$.

Veracity manipulation check. Truth tellers reported being overwhelmingly truthful ($M = 96.92$, $SD = 6.42$) whereas liars did not ($M = 17.50$, $SD = 26.71$). This difference was significant, $t(56.89) = 20.85$, $p < .001$, $d = 4.09$, 95% CI [3.39, 4.73]. The finding that liars reported that they were somewhat truthful was not surprising and fits well with the notion that liars, where possible, try to embed their lies in truthful stories (Leins, Fisher, & Ross, 2013).

Motivation. Prior to the interview, truth tellers ($M = 5.69$, $SD = 1.04$, 95% CI [5.40, 5.98]) and liars ($M = 5.92$, $SD = .76$, 95% CI [5.71, 6.14]) reported similar motivation to perform well, $F(1, 103) = 1.66$, $p = .200$, $d = 0.25$, 95% CI [0.14, 0.64]. After the interview, the motivation scores between truth tellers ($M = 5.64$, $SD = 1.16$, 95% CI [5.31, 5.96]) and liars ($M = 5.94$, $SD = .70$, 95% CI [5.75, 6.14]) remained similar, $F(1, 103) = 2.70$, $p = .103$, $d = 0.32$, 95% CI [0.07, 0.71].

Perceptions of instructions. We were interested in whether the information elicitation effect of the AIM technique would be implicit or explicit. A 2 (veracity: truth tellers vs. liars) x 2 (interview condition: AIM technique vs. control) ANOVA was conducted on perceptions of whether the interviewing instructions encouraged participants to report

more detail. A main effect emerged for veracity, $F(1, 100) = 12.60$, $p = .001$, $d = 0.67$, 95% CI [0.27, 1.06]), with truth tellers displaying a stronger belief that the instruction prompted additional information ($M = 5.73$, $SD = 1.25$, 95% CI [5.34, 6.12]), compared to liars ($M = 4.75$, $SD = 1.64$, 95% CI [4.36, 5.14]). A main effect of interviewing condition also emerged, $F(1, 100) = 8.95$, $p = .003$, $d = 0.56$, 95% CI [0.16, 0.95]). Participants who heard the AIM instruction held a stronger belief that the instruction prompted additional information ($M = 5.65$, $SD = 1.52$, 95% CI [5.27, 6.04]), compared to those in the control condition ($M = 4.83$, $SD = 1.45$, 95% CI [4.44, 5.22]).The interaction effect for veracity x interviewing condition was not significant, $F(1, 100) = 0.82$, $p = .368$, $f = 0.09$.

Instruction difficulty. A 2 (veracity: truth tellers vs. liars) x 2 (interview condition: AIM technique vs. control) ANOVA was conducted with the difficulty rating for the interviewing instruction as the dependent measure. A main effect for veracity emerged, $F(1, 100) = 13.94$, $p < .001$, $d = 0.74$, 95% CI [0.34, 1.13]), with truth tellers ($M = 6.52$, $SD = .64$, 95% CI [6.25, 6.80]) finding the instruction easier to understand, compared to liars ($M = 5.79$, $SD = 1.24$, 95% CI [5.51, 6.06]). There were no main effects for interviewing condition, or for veracity x interviewing condition, all $Fs < .04$, all $ps > .845$.

Likelihood of being believed. A 2 (veracity: truth tellers vs. liars) x 2 (interview condition: AIM technique vs. control) ANOVA with the likelihood to be believed as dependent variable revealed a main effect for veracity, $F(1, 100) = 68.87$, $p < .001$, $d = 1.64$, 95% CI [1.18, 2.07]), with truth tellers ($M = 5.98$, $SD = .85$, 95% CI [5.66, 6.31]) reporting that they felt more likely to be believed by the interviewer, compared to liars ($M = 4.06$, $SD = 1.42$, 95% CI [3.73, 4.38]). There were no main effects for interviewing condition, or for veracity x interviewing condition, all $Fs < .11$, all $ps > .741$.

Second interviewer. A 2 (veracity: truth tellers vs. liars) x 2 (interview condition: AIM technique vs. control) ANOVA with the likelihood of being interviewed by a second interviewer, as dependent variable, revealed a main effect for Veracity, $F(1, 100) = 24.03$, $p < .001$, $d = 0.96$, 95% CI [0.54, 1.36]), with truth tellers ($M = 2.87$, $SD = 1.17$, 95% CI [2.51, 3.22]) reporting that they felt less likely to be interviewed for a second time, compared to liars ($M = 4.10$, $SD = 1.39$, 95% CI [3.74, 4.45]). There were no main effects for interviewing condition, or for veracity x interviewing condition, all $Fs < 2.84$, all ps $> .095$.

Hypothesis testing

Due to the ongoing concern in psychological science regarding the usefulness of null hypothesis significance testing as a data analysis strategy (e.g. Cohen, 1994; Cumming, 2014), a Bayes Factor (BF) score using JASP software was calculated to determine how strongly our data supported the hypothesis (*see* Dienes, 2016; Wagenmakers, Morey, & Lee, 2016).

Table 1. Suggested interpretation scheme for the Bayes Factor (BF), as proposed by Jeffrey's (1961) and modified by Lee and Wagenmakers (2013).

Bayes factor $\boldsymbol{BF_{10}}$	**Interpretation**
> 100	Extreme evidence for H_1
30 – 100	Very strong evidence for H_1
10 – 30	Strong evidence for H_1
3 – 10	Moderate evidence for H_1
1 – 3	Anecdotal evidence for H_1
1	No evidence
1/3 – 1	Anecdotal evidence for H_0
1/3 – 1/10	Moderate evidence for H_0
1/10 – 1/30	Strong evidence for H_0
1/30 – 1/100	Very strong evidence for H_0

< 1/100	Extreme evidence for H_0

Frequency of Overall Details.

A 2 (veracity: truth tellers vs. liars) x 2 (interview condition: AIM technique vs. control) ANOVA, with overall detail as a dependent variable, revealed a main effect for veracity, $F(1, 100) = 23.83$, $p < .001$, $d = 0.80$, 95% CI [0.40, 1.20]), and interviewing condition, $F(1,100) = 11.16$, $p = .001$, $d = 0.54$, 95% CI [0.14, 0.92]). Truth tellers reported more than liars, and the AIM technique elicited more overall detail than the control condition. A significant interaction for veracity x interview condition emerged, $F(1, 100) = 28.10$, $p < .001$, $f = 0.53$. A follow up *t*-test revealed that truth tellers reported more overall detail in the AIM condition compared to truth tellers in the control condition, $t(30.90) = 4.92$, $p < .001$, $d = 1.36$, 95% CI [0.74, 1.95]. This analysis supports hypothesis 1. Bayesian analysis showed strong evidence in support of the alternative hypothesis, compared to the null hypothesis ($BF_{10} = 10.90$). In contrast, liars in the AIM condition, reported fewer overall details than liars in the control condition, $t(42.61) = -2.05$, $p = .024$ (one-tailed), $d = 0.57$, 95% CI [0.01, 1.11]. This analysis supports hypothesis 2. Bayesian analysis showed anecdotal evidence in support of the alternative hypothesis, compared to the null hypothesis ($BF_{10} = 2.93$).

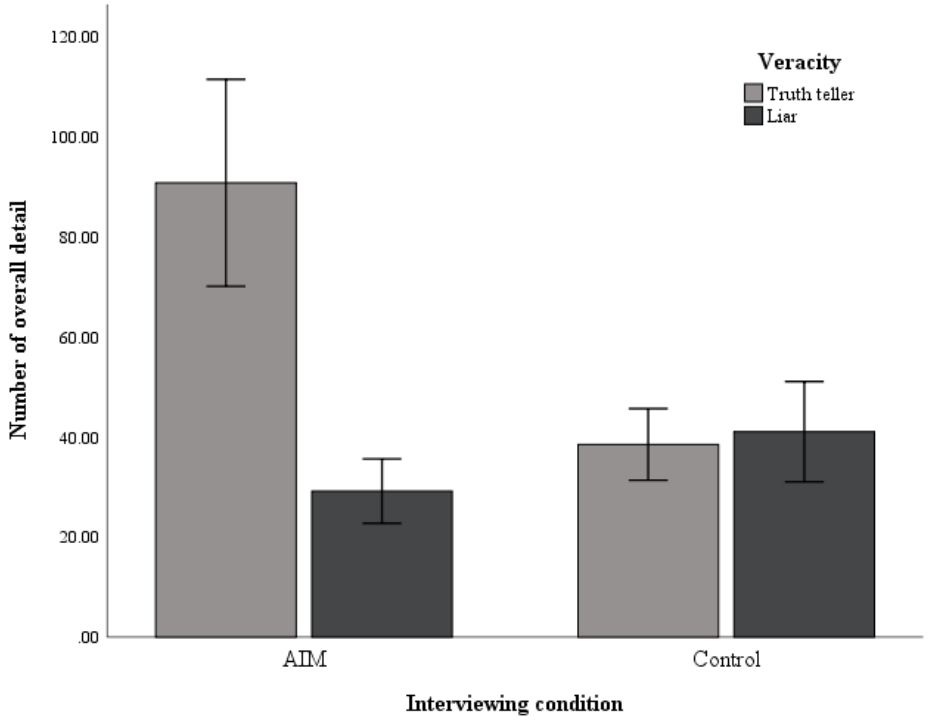

Figure 1: Bar graph showing the overall details for truth tellers and liars in the AIM and control conditions. Error bars represent 95% CIs.

Classification rates

Discriminant analyses tested the ability of "overall detail" to differentiate between truth tellers and liars in the AIM technique and control conditions. In all cases, *veracity* was the classifying variable. We present the cross-validated leave-one-out results, as this is more stable.

[table 2 goes here]

Veracity classification rates were higher in the AIM condition (80.8%), compared to the control condition (48.1%). Our findings support Hypothesis 3 in that the AIM technique could be used to aid in deception detection. The discriminant analysis is here primarily for practitioners and nonspecialised readers.

Receiver Operating Characteristic (ROC) analyses

To complement the series of discriminant analyses (and to formally test Hypothesis 3), we also conducted two Receiver Operating Characteristic (ROC) analyses for overall detail. This is because, unlike discriminant analysis, the Area Under the Curve (AUC) of a ROC curve (with 1 - specificity, i.e. false positive rate, plotted on the x-axis and sensitivity, i.e. true positive rate plotted on the y-axis) provides a measure of the diagnosticity of the criterion as a whole, and allows for a direct comparison of the AIM and control condition.

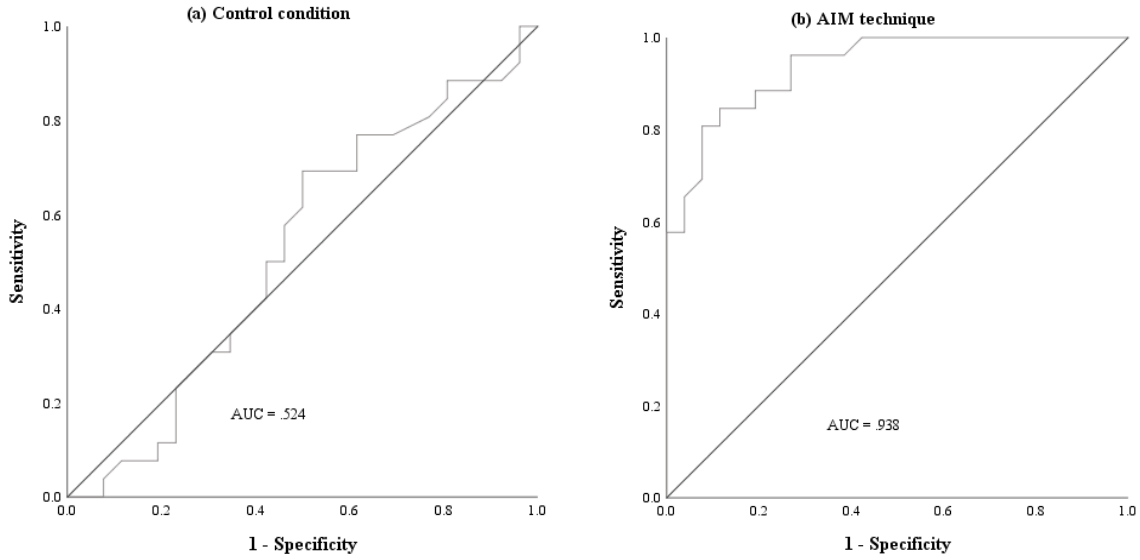

Figure. 2. (a): ROC curve (with AUC) for overall detail in the control condition. (b): ROC curve (with AUC) for overall detail in the AIM condition.

A direct comparison shows that the AIM instruction (AUC = .94, *SE* = .03) was more effective at correctly classifying truthful statements compared with the standard free recall question used in the control condition (AUC = .52, *SE* = .08), $p < .001$. Therefore, Hypothesis 3 is supported.

Discussion

The current study demonstrated that a new interviewing protocol enhances information elicitation for truth tellers, while simultaneously encouraging liars to withhold information. In the 'encouraging interviewees to say more' literature, tools (such as a Model Statement; Porter et al, 2017), techniques (such as sketching; Vrij et al, 2010), and protocols (such as a second interviewer; Mann et al; 2013) are designed with the single goal of prompting additional information from truth tellers only, while ignoring the verbal strategies of liars. To extend previous literature, we created an AIM technique that consists of two pre-retrieval components: (i) providing information about how investigators cannot detect an individual's inner mental state (as being honest or deceptive), and (ii) the association between lie-detection accuracy and verbal disclosure.

For truth tellers, the initial information emphasises how difficult lie-detection is and that longer, more detailed statements allow more accurate classification. They quickly realise that their credibility is not transparent, and that actually, by complying and providing more information they will more likely be viewed as innocent. This caused a shift in verbal strategies, towards become more forthcoming. The "report everything" instruction then acts as an illustration for the level of detail the interviewer is looking for.

Liars, in contrast, were presented with the same information but had different strategies than truth tellers. The metacognitive shift is based upon the assumption that providing less information will make lie-detection techniques less accurate and less reliable. As a result of this instruction, liars believe that by providing less information, they can avoid detection. This caused a withholding strategy to be adopted. For liars, the report everything instruction is subsequently disregarded.

Our findings support this prediction, as truth tellers provided more information when the AIM technique was used, compared to truth tellers in the control condition. As such, our AIM technique is effective in eliciting more information from interviewees, which is a core principle of effective interviewing (Bull, 2010; Fisher, 2010; Fisher, Milne, & Bull, 2011). Additionally, and as predicted, liars provided less information when the AIM technique was employed than in the control condition.

Interestingly, our data suggests that the AIM technique – particularly in regards to liar's verbal behaviours – may function implicitly, beyond awareness. We observed a dissociation between how liars subjectively believed they react in response to the AIM instruction, versus how they objectively reacted. Specifically, on their post interview questionnaire liars reported that hearing the AIM instruction made them report more information, compared to liars who received the control instruction. However, in terms of objective outcomes of the AIM instruction, liars actually reported less than those in the control condition.

Furthermore, an inspection of the effective sizes show that the AIM technique (compared to the control condition) was more effective at eliciting additional information from truth tellers (d = 1.36), than it was at supressing the amount of information reported by liars (d = 0.57). One explanation for this is that truth tellers can provide any information they can recall from memory. In contrast, liars may have been strategically unwilling to report too few details out of fear they will not appear as genuine. This makes theorical sense because more detailed statements are more likely to be perceived as credible (Bell & Loftus, 1989; Johnson, 2006; Johnson, Foley, Suengas, & Raye, 1988). Thus, the AIM technique (versus a control condition) may have been less effective at supressing the detail reported by liars due to a minimum disclosure limit in mind that they would not go below. Future research could investigate this.

As well as eliciting more information from truth tellers, we wanted to test whether this technique could enhance lie-detection (using discriminant analysis) based upon the overall detail provided by interviewees. We found that it did. In practical terms, within the control condition where a standard "report everything" instruction was used, the accuracy rate was 48.1%, consistent with the literature showing accuracy levels around chance expectancy (DePaulo, et al, 2003). In the AIM condition, accuracy levels reached 80.8%, demonstrating a much higher accuracy level for correctly classifying truth tellers and liars. We also tested this effect using a more robust method: ROC analyses. This showed the AIM technique was more effective at classification of truth tellers and liars, based on the overall detail they provided within their statement. Of course, it remains an empirical question if similar results would emerge if individuals provided credibility decisions. Future research should explore this possibility.

Practical implications

Although in its early stages, the AIM technique appears to be a promising new technique. Unlike other tools in the lie-detection literature, investigators can introduce this technique without concerns that it will prompt liars into providing the same level of detail as truth tellers (e.g. the Model Statement, Leal et al., 2015). We recommend more research be conducted to ensure the technique's replicability.

The current AIM technique examined the difference between liars and truth tellers in a between subjects design. In other words, lie-detection performance compared liars versus truth tellers. However, in real world settings, practitioners prefer within subjects credibility assessment tools, i.e. techniques that allow credibly assessments to be made on the bases of a single individuals performance. As such, the results of the current study may be difficult to apply. Future research should examine within subjects variants of the AIM technique. We

also note that our design contained some ambiguity as to whether the interviewer or a software programme would be used to access the credibility of the interviewees. This may have had an impact on the strategies implemented by truth tellers and liars.

Theoretically, the AIM technique could be further enhanced via the addition of a cognitive mnemonic component (Fisher & Geiselman, 1992; Memon, Meissner, & Fraser, 2010). Whereas a mnemonic could enhance truth tellers genuine recall (and therefore reporting ability), liars may be unable or unwilling to disclose many additional details. For example, liars may fabricate critical detail (regarding the transgression), and therefore lack genuine memory to enhance. Assuming liars use embedding strategies (see Leins, Fisher & Ross, 2013), a mnemonic may only enhance liars' recall of truthful details (i.e. within which their lie is embedded), rather than core information about the transgression itself.

In conclusion, our findings shows that a simple instruction can prompt quite different behaviour from truth tellers and liars, allowing better discrimination between them. This instruction represents an advance over existing protocols that should be easy for practitioners to implement.

Author Contributions

The study was conceptualised and designed by the first author. Data collection was conducted by the first and last authors. Data was analysed by the first author, with comments from the second, third and fourth authors. The manuscript was written by the first author with comments from the second, third and fourth authors.

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Table 2. *Discriminant analysis for the frequency of Total Detail as a Function of interview condition.*

	Accuracy rate			Wilks Lambda	Chi square	Canonical Correlation	P value	F value
	Truths (%)	Lies (%)	Total (%)					
AIM Technique	**69.2**	**92.3**	**80.8**	.593	25.86	.64	**<.001**	34.31
Control Condition	61.5	34.6	48.1	.996	.18	.06	.673	.18