Deception and Decay:

Verbal lie detection as a function of delay and encoding quality

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Abstract

We examined the effect of encoding quality and retention interval on the verbal accounts of truth tellers and liars. Truthful and deceptive participants (N = 149) reported a social interaction immediately or after a three-week delay. To manipulate encoding quality, the content of the exchange was important for, and intentionally attended to by, all liars and half of truth tellers (intentional encoding) but unimportant for half of truth tellers (incidental encoding). In the immediate condition, truth tellers in the intentional condition reported more details than liars and truth tellers in the incidental condition. All truth tellers reported fewer details after a delay (cf. immediately) whereas liars reported equivalent detail at both retrieval intervals. No differences by veracity group emerged in detail reported after delay. The oft-reported finding 'truth tellers provide more detail than liars' holds true when the event is intentionally encoded by truth tellers who are interviewed without delay.

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In standard deception experiments, truth tellers and liars are interviewed immediately after experiencing an event, with the event typically being meaningful (or made meaningful) in some way to both truth tellers and liars (Vrij, 2008). This context may not reflect all real life situations involving deception. For instance, sometimes suspects and witnesses are interviewed after extended delays. Also, the incident of interest to investigators may simply not have been important for, and therefore may not have attracted the attention of truth tellers. The aim of the current study was to address these issues by examining the popular verbal veracity cue *richness of detail* (Nahari & Pazuelo, 2015; Nahari & Vrij, 2015). This feature of an account can be a diagnostic cue to deceit when truth tellers and liars are interviewed immediately after an event that was made meaningful to them (Amado, Arce, Fariña, & Vilarino, 2016; Masip, Sporer, Garrido & Herrero, 2005; Vrij, 2008). In such scenarios, truth tellers typically provide more detail than liars (Vrij, 2005, 2008, 2015). Specifically, we examine how verbal behaviour of honest and deceptive interviewees varies as a function of two memorial factors relevant to many interview settings: encoding quality and delay.

Most psychologically-based credibility assessment techniques assume that liars and truth tellers enter interviews with differing mental states (e.g. Granhag & Hartwig, 2008; Vrij & Granhag, 2012). Whereas liars cannot take their credibility for granted and must manipulate the information they disclose (e.g. Colwell et al., 2014; McCornack, 1992), truth tellers can be forthcoming with information (Hartwig, Granhag, & Strömwall, 2007; Hartwig, Granhag, Strömwall & Doering, 2010). Truth teller's verbal behaviour is a function of the 'phenomenology of innocence' (Jordan & Hartwig, 2013); i.e. truth tellers believe their innocence is self-evident and thus adopt

a 'tell it as it is' verbal strategy (Hartwig et al., 2007; 2010). In contrast, liars typically fail to convey the amount of detail that truth tellers report, perhaps lacking the skills or imagination to do so (Vrij, 2008). Liars may also be reluctant to provide details that provide leads for investigators to check (Nahari, Vrij, & Fisher, 2014; Harvey, Vrij, Leal, Lafferty & Nahari, 2017). Unsurprisingly, truth tellers typically provide more detail than liars (Amado et al., 2016; Oberlader, Naefgen, Koppehele-Gossel, Quinten, Banse, & Schmidt, 2016).

Observers appear to be aware that truth tellers typically provide more detail than liars (Vrij, 2008). The more detailed a statement is perceived to be in terms of spatial information (details about locations or the arrangement of persons and/or objects), temporal information (details about when the event happened and the sequence of various events) and perceptual information (details about what was seen, heard, felt and smelt during the described activities), the more likely it will be judged as credible (Bell & Loftus, 1989). In sum, this *richness in detail* heuristic has received empirical support from the deception literature and richness of detail is both an *objective* (valid) and a *subjective* (believed) cue to truthfulness.

At least two factors pertinent to memory quality can contribute to a compromised truthful interviewee, reducing their ability to provide detailed statements. First, the ability of honest interviewees may be compromised if they did not attend to the information at the time of encoding. Goal-directed behaviour requires focusing attention upon specific stimuli whist ignoring distractions (e.g. Broadbent, 1958). Applying selective attention to perceptual events is a key factor in encoding (Mulligan, 1998) with divided attention during encoding reducing memory performance (Craik, Govoni, Naveh-Benjamin, & Anderson, 1996; Mulligan, 2003; Sauer & Hope, 2016). Critically, failure to attend towards a to-be-remembered (TBR)

event reduces the quality of the processing (Craik & Tulving, 1975). Specifically, compared to TBR-events that are attended to (and intentionally encoded), this incidental (unintentional) encoding results in a weaker, less detailed memory trace (e.g. Unsworth & Spillers, 2010). As what information can be accurately retrieved and reported is a function of what information was originally encoded, differences in encoding quality should be reflected in the quality of interviewees' statements.

Critically, both forms of encoding are relevant to forensic settings. For example, in the 7th July 2005 London bombings it was reported that the perpetrators executed a practice run prior to the attack (official-documents. gov.uk/document/hc0506/hc10/1087/1087). Investigators may thus have considered questioning individuals travelling on underground transport in London that week, although the information provided by these potential witnesses would likely have been encoded incidentally. Alternatively, informants may deliberately collect information (Soufan, 2011) and that information would be encoded intentionally.

Second, the ability of an honest interviewee to recall information may be compromised by memory decay (forgetting) over time. Lengthy delay between an interviewee obtaining information and disclosing that information during an interview is often unavoidable. Unfortunately, the quality of witness accounts may be time-critical. As the interval between witnessing (encoding) an event and being interviewed about it increases, so does the risk of memory decay: delay reduces both the completeness and accuracy of recall (Penrod, Loftus & Winkler, 1982; Wixted & Ebbesen, 1991, 1997), because information held in memory becomes less accessible with increased time (Anderson, 1983; Ayers & Reder, 1998). The loss of information occurs rapidly at first before plateauing ('forgetting curve', Ebbinghaus, 1885).

Whereas it is acknowledged that a good memory is fundamental to successful

deception (Gombos, 2006; Sporer & Schwandt, 2006; Vrij, 2014), it is less often stated that deceivers require good metacognition to lie effectively (c.f. Lancaster, 2011). Vrij et al. (2009) speculated that the retention interval between encoding and retrieval could prove especially problematic for liars and that liars may misjudge the appropriate level of detail to report in order to appear credible. Thus, liars could potentially make a metacognitive error by calibrating their verbal behaviour on the basis of false beliefs about truth teller's memory performance over time.

Individuals generally do not understand the nature (and limitations) of memory (Legaut & Laurence, 2007; Loftus & Loftus, 1980; Ost, et al., 2016; Simons & Chabris, 2011) and specifically underestimate the extent of forgetting over time (Koriat, Bjork, Sheffer, Bar, 2004). This pattern of failing to correctly understand the degree to which memory can change over time is referred to as a 'stability bias' (Kornell et al., 2009). If liars display a stability bias, and thus have erroneous metacognitive beliefs regarding memory, they may plausibly fail to adequately regulate their verbal output to take into account the effect of delay (e.g. Vrij et al., 2009).

Based upon these theoretical considerations, we predict that truth tellers for whom the target event is made important (and intentionally encoded) will provide a more detailed and accurate account than truth tellers for whom the target event is not important (incidentally encoded). As we did not orthogonally manipulate veracity and encoding condition (incidental liars makes little sense), this resulted in three veracity conditions: incidental truth tellers, intentional truth tellers and intentional liars. Further, and consistent with previous literature, we predict that both groups of truth tellers will provide more detailed and more accurate accounts than liars (Hypothesis 1).

We also predict that truth tellers in Intentional and Incidental conditions interviewed immediately after the event will provide more details than those interviewed after a three-week delay, whereas no similar decline in the amount of information provided is expected for liars (Hypothesis 2).

As we predict that the greatest differences between veracity groups will occur in the immediate condition, we expect accuracy rates for correctly classifying truth tellers and liars to be higher in the immediate condition than in the delay condition (Hypothesis 3).

We further explored the effect of delay on accuracy rates of providing correct information and were particularly interested in a possible change in accuracy rates for liars over time. Liars tend to embed their lies in truthful stories (Leins, Fisher, & Ross, 2013), so we expect them to provide some accurate detail in the immediate interview condition. If their tendency to tell embedded lies does not change over time (and there is no theoretical reason as to suggest it should) liars will have similar accuracy rates of providing correct information in the immediate and delayed interviews.

Method

Design

A 3 (Veracity: intentional encoding truth teller vs. incidental encoding truth teller vs. intentional encoding liar) x 2 (Interview Time: immediate vs. delayed) between subject design was used with four dependent variables: the number of i) overall detail reported, ii) correct details reported, iii) incorrect details reported, and iv) the accuracy rate for the overall details reported.

Participants

A total of 149 volunteers, comprising of 98 females and 51 males, aged between 18 and 56 years ($M = 24.46$ years, $SD = 8.73$, 95% CI [23.15, 25.87]), from the University's undergraduate ($n=100$), postgraduate ($n=23$) and staff ($n=26$) communities, participated in the study.

Procedure outline.

Participants watched a video recording and also witnessed a social interaction. The latter is the target event. The video recording element was included in the design to distract the truth tellers in the unintentional encoding condition from the real purpose of the experiment (the social interaction). The attention of liars' and truth tellers' in the intentional encoding condition was directed towards the social interaction by making it critical to their mission goal. In contrast, no indication was given to the truth tellers in the incidental encoding condition that the social interaction was an integral part of the study.

Procedure

Participants were recruited via adverts on the University's online participant pool. Individuals arrived at the laboratory at pre-arranged times and were informed that the study was about detecting deception within an intelligence setting. Each participant was given an information sheet about the study and informed written consent was obtained.

All participants were randomly allocated to either the intentional encoding truth teller ($n = 50$), incidental encoding truth teller ($n = 49$) or intentional encoding liar ($n = 50$) veracity conditions. Half of the participants per group where then randomly allocated to either the delay ($n = 75$) or the no delay ($n = 74$) condition.

All participants were told the experiment involved assuming the role of an intelligence operative with access to a 'classified video recording' of an intelligence

briefing. We have used this recording (video) in previous research (Shaw et.al, 2013; Ewens et al., 2014, 2015). The video is ostensibly about intelligence operatives who are planning to plant a surveillance device. All participants were told they should try and remember as many details about the briefing video as possible. Additionally, it was explained i) that note taking was prohibited and ii) that the briefing video could only be observed once. All participants were told they would be interviewed later about the briefing video.

Truth tellers in the incidental encoding condition ($n = 49$) were told that for the experiment they are in the 'Blue' team and will be interviewed by a member of their own team. As such, they should be totally truthful to the interviewer and provide them with as much information as they can recall.

Truth tellers in the intentional encoding condition ($n = 50$) were provided the same information as incidental truth tellers. Additionally, intentional condition truth tellers were informed that there are also participants on the 'Red' team taking part in the experiment at the same time, and thus they should be mindful as to what members of other teams may be doing. They were instructed that if they encountered anyone using the code words 'Rocket Science' this meant that those people were also on their 'Blue' team. They were also informed that if they if they did not hear those words then they could assume that the other participants were members of the opposing Red team and the truth tellers should pay attention to anything they do. It was explained that such information maybe useful to the Blue team later in the experiment.

Liars ($n = 50$) in the intentional encoding condition were told that for the experiment they were on the 'Red' team and would be interviewed by a member of the opposing 'Blue' team and as such their task was to mislead the interviewer about certain details of the video, including (i) what the surveillance device looked like, (ii)

its functions and, also (iii) the location that was chosen to plant the device. Liars in the intentional encoding condition were told that the interviewer knew that the device would be placed somewhere, but did not know where. They were instructed that they should not reveal the location that was selected to hide the surveillance device and their objective was to mislead the investigator by using the third location mentioned in the video as the location that was selected to plant the device. In reality, the surveillance device was hidden in a different location. They were also told to lie about the device itself. Participants were informed the interviewer knew something about the device but did not have all the details, and that it was not clear exactly what the interviewer knew. Because of this, liars in the intentional encoding condition were told to provide some truthful and some false information about the surveillance device, as this would help them appear cooperative without having to tell the interviewer everything. Finally, they were informed they should be mindful as to what other Red team members may be doing in the experiment. Liars in the intentional encoding condition were told that if they encountered anyone during the study who used the code word 'thermodynamics', those individuals where also on the Red team. Critically, the interviewer of the opposing 'Blue' team would probably be aware that they taking part so they should not deny seeing them. However, participants were also instructed that they should protect these individuals' identities by not telling the truth about what Red team members looked like and what they said, if asked by the interviewer.

All participants were told that if the interviewer judged them as credible, they would receive £10 (in the immediate condition) or £15 (in the delay condition). This difference in compensation was pragmatic, due to the requirement in the delayed interviewing condition to attend two experimental sessions (and incur associated

travel costs) compared with participants in the immediate interviewing condition who only attended a single session. Participants were also informed that interviewees rated as cooperative by the interviewer would be entered into a prize draw to win up to £150 in prize money. However, if participants did not appear cooperative, they would instead be asked to write a statement about what happened during the study. Participants were instructed not to discus the study with others and then taken to the waiting room and told to wait until the experimenter collected them.

Target event

While waiting to watch the video, all participants witnessed a staged target event. This event consisted of a conversation, followed by a document exchange, between two confederates unknown to the participants. Upon entering the waiting room, the participant was instructed to take a seat (the seat location was identical for all participants) and wait to be collected by the experimenter. One confederate (A) was already seated in the waiting room (again, this location was identical for all participants). After 30 seconds, a second confederate (B) entered the waiting room and walked past the participant to sit next to the first confederate. Both confederates then engaged in the scripted exchange (which included the word 'thermodynamics'), before a third confederate entered the waiting room with an inquiry before leaving. The exchange then continues between confederates A and B before the experimenter returns and collects the participant (for a description of the exchange, see Appendix 1). To check the standardisation of the scripted protocol, the duration of the staged social interaction was recorded for each participant, (M= 103.80 seconds; range: 80-135; SD = 10.80, 95% CI [102.13, 105.60]). An ANOVA revealed no differences for duration with respect to Veracity, $F(2,143) = 0.094$, $p = 0.910$ and Interview Time, $F(1, 143) = 0.115$, $p = 0.735$. Furthermore, the Veracity X Interview Time interaction

was not significant, $F(2,143) = 0.906$, $p = 0.406$.

Immediately after completion of the social interaction, the experimenter entered the room to collect the participant and escort him/her to watch the briefing video in the laboratory. Once seated, the participants were presented the briefing video, which lasted 6 minutes and 29 seconds, on a laptop. After the video, participants in the delay condition were told that they completed the first phase of the study. Contact details were taken (email address and mobile phone number), and dates and times where confirmed for the individuals to return in three-weeks time. Upon their return three-weeks later, participants in the delay condition progressed to the second phase of the study. Participants in the immediate condition progressed immediately into the second phase of the study.

The experimenter began the second phase of the experiment by asking the participants what topics they thought they would be interviewed about (serving as a manipulation check). Participants were then informed they would be questioned about both the intelligence briefing video and the social interaction in the waiting room. Participants were offered as much time as they required prior to the interview to prepare themselves. After indicating they were prepared for the interview, all participants completed the pre-interview questionnaire. The participants were asked for their demographic information (age, gender, occupation) and to rate their preparation for the interview (on 7-point Likert scales, ranging from 1 (very poor) to 7 (very good); 1 (pointless) to 7 (useful); 1 (insufficient) to 7 (sufficient); and 1 (incomplete) to 7 (thorough). These four items were clustered into one 'preparation' variable, Cronbach's alpha = .90. They were also asked if they developed a strategy for the interview, to describe such a strategy in detail, and if that had not developed a strategy, to explain why not. Upon completion, participants where taken to be

interviewed.

Our interview protocol consisted of two sets of questions: the first (questions 1-5) concerned the waiting room interaction and the second (questions 6-8) concerned the video (see Appendix 2 for the questioning schedule). The order and composition of the question protocol was identical for all interviews. All interviews were audio recorded. After the interview, participants returned to the laboratory and were given a post interview questionnaire. This asked participants to report their motivation for performing well during the interview (on an 7-point Likert Scale, ranging from 1 extremely unmotivated to 7 extremely motivated), to estimate the likelihood (on an 11-point Likert scale, ranging from 0% to 100% likely) of (i) receiving the monetary reward and (ii) having to write the statement, and to report percentage of truthful information they disclosed in the interview (also on an 11-point Likert Scale, ranging from 0% to 100%)). Upon completion participants where thanked, debriefed and compensated for their time.

Coding.

All audiotapes were transcribed and the verbal coding was conducted using these transcripts. The statements were rated by one coder (blind to the experimental conditions) who scored the occurrence of perceptual detail (information about what was seen, heard, felt and smelt during the described activities, e.g. 'She talked loudly', 'There was man in a jacket already there'), spatial detail (information about locations or the arrangement of persons and/or objects, e.g. 'the sofa in the far left corner of the room under the window', 'The man was sitting to the right of the women') and temporal detail (information about when the event happened and explicit descriptions of the sequence of various events, 'about two minutes later a women entered', 'After no one replied, she left').

The procedure used to quantify accuracy was identical for all participants regardless of Veracity condition. To code for accuracy of the information provided, a detailed script was created for both the social interaction in the waiting room (for each individual participant) and the briefing video (identical for all participants) classifying each unit of information as spatial, temporal or perceptual. The script for the waiting room included information about the confederate's appearances, verbatim records of what was said, when it was said and by whom, together with the sequence and description of what occurred. Numerous confederates took part in the study and their appearances differed; also appearances of the same confederate could differ on different days they took part. To obtain ground truth about appearances of the confederates, for each participant a photo was taken of the waiting room with the two confederates the participant witnessed present (the participant was not in the waiting room when the photo was taken). The script for the briefing video contained similar information as the social interaction script but additionally included specific information about the spy device's function, appearance and location, together with descriptions of the 'agents' in the video. Reported detail that matched the participant's respective script was scored as correct, whereas detail that did not match the script was scored as incorrect. Spatial, temporal and perceptual detail that did not relate to the coding script was considered irrelevant. Such irrelevant detail did not occur for the video description and rarely occurred for the social interaction. Since we cannot determine the ground truth of these details they were excluded from the detail and accuracy coding. Total detail was calculated as the sum of reported relevant spatial, temporal and perceptual detail. Accuracy was calculated at the number of accurate detail divided by the number of total detail.

The three sub-categories of detail were introduced to facilitate (inter-rater)

reliability coding and to explore whether, for example, one type of detail is more sensitive to decay than another type of detail. Since no hypothesis was formulated about this, we included these analyses as supplementary material.

A second coder (also blind to the veracity of the statements) coded a random selection of 30 statements (20%) for all the dependent measures. Inter-rater reliabilities between the two coders for the occurrence frequency of perceptual, spatial and temporal detail, as well as for accurate information, were measured via intra-class correlation coefficients (ICC). The ICC was high and therefore satisfactory for total spatial details [ICC] = .84, temporal details [ICC] = .85, perceptual details [ICC] = .90 and total details [ICC = .90], and also for the percentage of correct spatial details [ICC] = .78, temporal details [ICC] = .76, perceptual details [ICC] = .82 and total details [.95].

One coder read all the strategies reported by the participants and designed a coding scheme system based on these answers. A total of 22 separate answer categories emerged. A second coder, after being informed about the coding scheme, allocated the answers given by a sample of 30 participants to these 22 categories. The inter-rater reliability between the two coders was good, Kappa = 0.88, 95% CI [0.68, 1.00] (p<0.001). Discrepancies in coding were identified and resolved between the two scorers.

Results

Veracity manipulation check.

Two 3 (Veracity) x 2 (Delay) ANOVAs were conducted with the estimated likelihood of (i) receiving the monetary reward and (ii) having to write a statement as the dependent variables. These analyses revealed significant main effects for Veracity regarding both the monetary incentive, $F(2, 143) = 6.661$, $p = 0.002$, $\eta_p^2 = 0.09$, and

writing a statement, $F(2, 143) = 11.352$, $p = 0.003$, $\eta_p^2 = 0.08$. Scheffe tests revealed that truth tellers in the intentional encoding condition (henceforth, intentional truth tellers) ($M = 5.54$, $SD = 1.20$, 95% CI [5.179, 5.901]) and truth tellers in the incidental encoding condition (henceforth, incidental truth tellers) ($M = 5.90$, $SD = 1.14$, 95% CI [5.53, 6.26]) thought it more likely they would receive the reward than liars in the intentional encoding condition (henceforth, intentional liars) ($M = 4.96$, $SD = 1.47$, 95% CI [4.60, 5.32]), whereas intentional liars ($M = 3.24$, $SD = 1.49$, 95% CI [2.86, 3.63]) thought it more likely they would have to write a statement versus both intentional truth tellers ($M = 2.40$, $SD = 1.20$, 95% CI [2.02, 2.79]) and incidental truth tellers ($M = 2.43$, $SD = 1.43$, 95% CI [2.04, 2.82]). The Veracity main effect and the Veracity X Interview Time interaction effects were not significant, both $F's < 0.737$ both $p's > 0.480$.

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted with the reported percentage of truthful information disclosed as the dependent variable. The analysis showed a main effect for Veracity, $F(2, 143) = 366.362$, MSE $= 56687.435$, $p < 0.001$, $\eta_p^2 = .837$. Scheffe tests revealed that intentional liars ($M = 32.40\%$, $SD = 14.51$, 95% CI [28.26, 36.43]) reported providing significantly less truthful information during the interview than either intentional truth tellers ($M = 91.20\%$, $SD = 12.23$, 95% CI [87.56, 94.21]) or incidental truth tellers ($M = 90.43$, $SD = 9.99$, 95% CI [87.73, 93.54]). Scheffe tests showed no significant difference between intentional truth tellers and incidental truth tellers. The Interview Time and Veracity X Interview Time interaction were not significant, both $F's < 0.85$, both $p's > 0.43$.

Attention manipulation check.

A logistic regression was performed to examine the effects of Veracity (intentional truth teller vs. incidental truth teller vs. intentional liar) and Interview Time (immediate vs. delayed) on the participant's attention to either just the video or the video and social interaction. The logistic regression model was statistically significant $\chi^2(3) = 85.389$, $p > .001$. The model explained 61.0% (Nagelkerke's R^2) of the variance of attention and correctly classified 88.6% of all cases (83.0% of those attending towards just the video, and 91.1% of those attending towards the video and the social interaction). Incidental truth tellers where .014 times (95% CI [.004, .057]) less likely to attend to both the video and social interaction than intentional liars (p <.001). The difference between Intentional truth tellers and intentional liars was not significant (p =.465). Interview time was not a significant predictor (p =.831). Collectively, these findings support the validity of the veracity manipulation.

Supplementary analyses

For additional analyses of participant motivation, preparation, statement word length, classificatory accuracy rates, as well as for tests distinguishing between spatial, temporal and perceptual detail, see the supplementary analyses section.

Hypothesis testing

As mentioned earlier, exposure to the briefing video and recall of that video were introduced in the study as a distraction for the incidental truth tellers. That is, they needed to think that the study was about that video and that the social interaction was irrelevant (which is what they indeed thought, see above). Also, the attention manipulation was only related to the social interaction and not to the briefing video, as all truth tellers (in both the intentional and incidental encoding conditions) were

asked to pay close attention to the video. We therefore do not present the briefing video findings in this article and restrict ourselves to reporting the findings for the social interaction. For interested readers, a full description of the briefing video findings is available via contacting the first author. The results of the briefing video followed virtually the same pattern as those for the social interaction so no information is lost by not presenting the briefing video results.

      Correct details.

      To examine the differences in number of correct details reported, we conducted a 3 (Veracity) X 2 (Interview Time) ANOVA using the number of correct (accurate) reported detail as the dependent variable. This analysis revealed a significant main effect for Veracity, $F(2, 144)=31.659$, MSE= 99566.160, $p<0.001$, $\eta_p^2 = .31$. Scheffe tests revealed that intentional truth tellers ($M = 184.94$, $SD = 80.99$, 95% CI [164.03, 206.49]) reported significantly more correct detail than both incidental truth tellers ($M = 135.14$, $SD = 54.33$, 95% CI [118.23, 150.12]) and intentional liars ($M = 95.90$, $SD = 31.97$, 95% CI [87.16, 104.65]). The difference between incidental truth tellers and intentional liars was significant. A significant main effect also emerged for Interview Time, $F(1, 144)= 12.058$, MSE= 37921.5000, $p=0.001$, $\eta_p^2 =.08$. Participants in the Immediate Interview Condition ($M=154.56$, $SD=54.33$, 95% CI [137.80, 172.06]) reported significantly more correct detail than participants in the Delayed condition (M= 122.76, SD= 53.72, 95% CI [111.10, 133.79]). Furthermore, the Veracity x Interview Time interaction was significant, $F(2, 144)= 4.017$, MSE=12632.720, $p=.020$, $\eta_p^2 = .02$.

[Insert Table 1 about here]

      As Table 1 shows (second rows in each sub-section), intentional truth tellers in the immediate condition reported more correct detail versus intentional truth tellers in

the delayed condition. Incidental truth tellers in the immediate condition reported more correct detail versus incidental truth tellers in the delayed condition. No difference emerged between intentional liars in the immediate and intentional liars in the delay interview conditions for correct detail reported.

Incorrect details.

To examine the difference in number of incorrect detail reported, we conducted a 3 (Veracity) X 2 (Interview Time) ANOVA using the number of incorrect (inaccurate) reported detail as the dependent variable. This analysis revealed a significant main effect for Veracity, $F(2, 144)=11.810$, MSE= 15945.627, $p<0.001$, $\eta p^2 = .14$. Scheffe tests revealed that intentional liars ($M = 58.76$, $SD = 48.64$, 95% CI [47.13, 73.19]) reported significantly more incorrect detail than both intentional truth tellers ($M= 24.80$, $SD= 15.74$, 95% CI [20.68, 29.21]) and incidental truth tellers ($M = 32.20$, $SD = 37.32$, 95% CI [23.68, 43.87]). The difference between intentional truth tellers and incidental truth tellers was not significant. The main effect for Interview Time was not significant, $F(1, 144)= .410$, MSE= 552.96, $p=.523$, $\eta p^2 <.01$. Furthermore, the Veracity x Interview Time interaction was not significant, $F(2, 144)= .487$, MSE=657.68, $p=.615$, $\eta p^2 = .01$.

Total details

To examine differences in number of total details reported (sum total of correct and incorrect detail), we conducted a 3 (Veracity) X 2 ANOVA using total reported detail as the dependent variable. This analysis revealed a significant main effect for Veracity, $F(2, 143)= 7.832$, MSE = 38152.166, $p = 0.001$, $\eta_p^2 = .10$. Scheffe tests revealed that intentional truth tellers ($M = 207.36$, $SD = 89.57$, 95% CI [182.40, 232.91]) reported significantly more total detail than both incidental truth tellers ($M = 167.04$, $SD = 65.64$, 95% CI [147.67, 184.70]) and intentional liars ($M = 154.30$, $SD =$

56.04, 95% CI [139.69, 173.59]). The difference between incidental truth tellers and incidental liars was not statistically significant. This partially supports Hypothesis 1. A significant main effect also emerged for Interview Time, $F(1, 143) = 5.208$, MSE = 25379.280, $p = 0.024$, $\eta_p^2 = .035$. Participants in the immediate condition ($M = 189.41$, $SD = 79.82$, 95% CI [172.10, 205.86]) reported more total details than participants in the delayed condition ($M = 163.31$, $SD = 67.77$, 95% CI [147.23, 178.38]). Furthermore, the Veracity X Interview Time interaction was significant, $F(2, 143) = 3.279$, MSE = 15971.137, $p = 0.041$, $\eta_p^2 = .044$.

As Table 1 shows (first rows in each sub-section), intentional truth tellers reported more total detail than incidental truth tellers in the delayed interviewing condition. Incidental truth tellers in the immediate interviewing condition reported more total detail than incidental truth tellers in the delayed interviewing condition. The difference did not reach statistical significance ($p = 0.094$), with a medium effect size, $d = 0.48$. No difference emerged between intentional liars in the immediate interviewing condition and intentional liars in the delayed interviewing condition (note that liars in the delayed condition reported more total detail [$M = 160.92$] than liars in the immediate condition [$M = 148.40$]). These results support Hypothesis 2.

Percentage of total correct detail reported

A 3 (Veracity) X 2 (Interview Time) ANOVA was conducted using percentage of total correct detail reported as the dependent variable. This analysis revealed a significant main effect for Veracity, $F(2, 143) = 240.556$, MSE = 0.881, $p < 0.001$, $\eta_p^2 = .77$. Scheffe tests revealed that intentional truth tellers ($M = 87.86\%$, $SD = 4.94$, 95% CI [86.39, 89.14]) reported a significantly higher percentage of correct total detail than incidental truth tellers ($M = 80.57$, $SD = 6.29$, 95% CI [78.90, 82.32]). Furthermore, both intentional truth tellers and incidental truth tellers reported

a higher percentage of correct total detail versus intentional liars ($M = 62.10$, $SD = 7.49$, 95% CI [59.92, 64.23]). These results support Hypothesis 1.

A significant main effect also emerged for Interview Time, $F(1, 143) = 15.316$, MSE = 0.056, $p < 0.001$, $\eta p^2 = .097$. Participants in the immediate condition ($M = 78.75\%$, $SD = 11.78$, 95% CI [74.69, 78.83]) reported a higher percentage of total correct overall details than participants in the delayed condition ($M = 74.91$, $SD = 13.15$, 95% CI [71.59, 77.75]). The Veracity X Interview Time interaction was not significant, $F(2, 143) = 0.601$, MSE = 0.002, $p = 0.550$, $\eta p^2 = .008$.

Veracity classification.

We tested the ability of overall detail to discriminate between intentional truth tellers, incidental truth tellers and intentional liars in the (i) immediate and (ii) delayed interviewing conditions by running two discriminant analyses. In both cases, the objective Veracity group belonging (truth tellers in the intentional encoding condition, truth tellers in the incidental encoding condition, liars in the intentional encoding condition) was the classifying variable and reported total detail was the predictor.

Table 2 about here

As Table 2 shows, a significant discriminant function emerged for distinguishing participants in the immediate interviewing condition, $\chi^2(2) = 27.984$, Wilks' $\lambda = 0.674$, $p < 0.001$ (canonical correlation was .57). The function correctly classified 56.0% of the intentional truth tellers, 29.2% of the incidental truth tellers and 68.0% of the intentional liars, resulting in an overall total accuracy rate of 54.1% of the participants. (Note that in this discriminant analysis 33.3% represents chance). The discriminant function for distinguishing between participants in the delayed

interview condition was not significant, $\chi^2(2) = 2.503$, Wilks' $\lambda = 0.966$, $p = 0.286$, (canonical correlation was .19). Thus, superior classification emerged for distinguishing between participants in the immediate (versus delay) interviewing condition, supporting Hypothesis 3.

Table 2 shows that in the immediate condition, a poor accuracy rate was obtained for the incidental truth tellers in particular. To investigate the ability of overall detail to distinguish between liars and truth tellers generally, we ran an additional pair of discriminant analyses. We distinguished between immediate and delayed interviewing conditions but collapsed the truth tellers in the intentional encoding condition and truth tellers in the incidental encoding condition into a single veracity group ('truth tellers') for comparison versus liars. In both cases, the objective Veracity group belonging (truth tellers or liar) was the classifying variable and overall reported detail was the predictor. A significant discriminant function emerged for distinguishing between truth tellers and liars in the immediate interviewing condition, $\chi^2(1) = 17.415$, Wilks' $\lambda = 0.784$, $p < 0.001$, (canonical correlation was .47). This function correctly classified 64.0% of liars and 85.7% of truth tellers, resulting in an overall accuracy rate of 78.4%. The discriminant function for distinguishing between liars and truth tellers in the delayed interview condition was not significant, $\chi^2(1) = 0.038$, Wilks' $\lambda = 0.999$, $p = 0.845$, (canonical correlation was 0.02). For additional classificatory results, see the supplementary analyses section.[1]

Participants' reported strategies.

Table 3 about here

Out of the 22 different answer categories, seven were related to detail and memory, the two issues we were interested in. We only report the strategies related to these two concepts. As Table 3 shows, for liars the most popular strategy in both the

immediate and delayed conditions was to 'embed the lie in a truthful story'. In addition, a substantial percentage of liars in the immediate condition mentioned 'reporting many details' and 'keep it simple' as strategies, the former strategy emerged to a lesser extent in the delay condition and the latter strategy did not emerge at all in the delay condition. In fact, apart from embedding lies no further clear strategy emerged for liars in the delay condition. Table 3 further shows that most truth tellers (in the intentional encoding condition or incidental encoding condition) did not have a strategy. They justified this by reporting that a strategy is not required because they were just telling the truth.

Discussion

The current study showed that the diagnostic utility of the richness of detail heuristic has boundary conditions. As predicted, truth tellers in the delayed condition reported fewer details than truth tellers in the immediate condition. This pattern of forgetting across time is consistent with the memory literature (e.g. Anderson, 1983; Ebbinghaus, 1885; Wixted & Ebbesen, 1997). Furthermore, truth tellers disclosed more details when the to-be-remembered (TBR) event was attended to and intentionally encoded versus not attended to and, likely, only incidentally encoded. This finding makes good theoretical sense: the application of deliberate attention improves memory performance (Craik & Tulving, 1975; Mulligan, 1998; Unsworth & Spillers, 2010). Accordingly, in the immediate interviewing condition, truth tellers in the intentional condition reported more detail than either truth tellers in the incidental condition or liars. This finding is consistent with the deception literature: liars typically disclose less detail than truth tellers (Amado et al., 2016; Masip et al., 2005). However, in the delayed interviewing condition, a different pattern emerged: truth tellers in the intentional condition, truth tellers in the incidental condition, and liars

did not differ in terms of reported detail and, as a result, discriminating between them using detail as the dependent measure was not possible. Hence, our results suggest a critical caveat to the typical finding that truth tellers disclose more detailed information than liars. This patterns only holds when i) interviews take place immediately after a TBR event, and ii) the TBR event was intentionally encoded by truth tellers.

The finding of boundary conditions to the utility of the 'richness of detail' heuristic is entirely consistent with classical memory theory (e.g. Craik & Tulving, 1975; Ebbinghaus, 1885). Of greater theoretical novelty is the observed pattern of results for liars: liars did not differ in the number of details reported across interviewing time conditions, reflecting a 'stability bias' (Koriat et al., 2004; Kornell et al., 2009), i.e. a failure to calibrate their verbal outputs to accurately take into account the reconstructive nature of real memory. Speculatively, it is possible liars revisited their memory for the social interaction during the 3-week delay. Elaborative retrieval following encoding episodic events 'inoculates' against memory decay (Gabbert, Hope, & Fisher, 2009; Gabbert, Hope, Fisher, & Jamieson, 2012; Hope, Gabbert, & Fisher, 2011), a process analogous to the testing effect (Roediger, Putnam & Smith, 2011; also see Roediger & Karpicke, 2006; Karpicke & Roediger, 2008). Typically, truth tellers prepare less for interviews than liars (e.g. Tedeschini, 2012; Vrij, Leal, Granhag, Mann, Fisher, Hillman, & Sperry, 2009; Vrij, Leal, Mann, Vernham & Brankaert, 2012). Thus, truth tellers in the intentional condition may have engaged in less repeated retrieval compared to liars in the intentional condition, reducing the degree of memory inoculation for truth tellers (versus liars). This is consistent with the large decline in memory performance observed for truth tellers in the intentional encoding condition observed between the immediate and delay

interview conditions. However, if liars have engaged in repeated retrieval, a testing-effect phenomena may underpin liar's overestimation of the level of detail to report. According to this argument, liars fail to apply their theory-based knowledge (that memory decays) because they utilize their experience-based cues (i.e. their strong memory for the critical event) to calibrate how much detail to report. Future research should explore this possibility.

The empirical effect of encoding condition upon verbal disclosures should be interpreted within the experimental context. Specifically, the lack of differences in terms of detail between intentional and incidental truth tellers in the delay condition could be attenuated by the nature of the experimental task. For example, the social interaction that the truth tellers in the intentional condition and lying participants experienced and discussed was of a short duration and of no personal importance to them (outside the experimental scenario), whereas the truth tellers in the incidental condition had no reason to attend to the interaction. Plausibly, different findings will emerge when truth tellers discuss rich event in the past that had real importance to them. For example, when truth tellers and liars discussed a holiday trip they made in the past year, the statements of truth tellers were more detailed than the statements of liar's who made up a story about such a trip (Vrij et al., 2016). However, the general principle that memory is malleable and the completeness (as well as accuracy) of recalls systematically decreases as the delay between witnessing an event and recall increases also applies to such richer and more important events.

Methodologically, the veracity and encoding condition were not orthogonally manipulated in this study, as this would have resulted in an addition 'incidental liar' condition (i.e. individuals lying about events they did not attend to). This theoretical possibility appears unrelated to real-world deception and was not examined.

Furthermore, it could be argued that the task for liars and truth tellers in the intentional condition where more complex than that for truth tellers in the incidental condition. Specifically, higher task complexity experienced by the truth tellers and liars in the intentional conditions (versus truth tellers in the incidental condition) may have impaired memory performance (Oberauer, 2002). Interestingly, the opposite pattern emerged: truth tellers in the intentional condition (in the immediate condition) displayed superior recall than truth tellers in the incidental condition and liars. Thus, asymmetric imposed cognitive load cannot account for the differences in memory performance reported between the veracity groups.

In conclusion, memorial factors such as delay interval and encoding condition appear to constrain truth tellers' verbal behaviour. The finding that truth tellers experience memory decay, combined with the finding that liars showed a stability bias and tended to report the same amount of detail whether questioned immediately or after a delay, has important consequences for forensic verbal lie detection. Essentially, the diagnostic utility of the richness of detail heuristic has clear boundary conditions: delay collapses the typically observed difference between liars and truth tellers.

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Table 1. *Overall detail, total correct detail, total incorrect detail and percentage of correct detail reported for the Social Interaction as a Function of Veracity and Interview Time*

	Immediate condition	Delay condition	*t*	*p*	*Cohen's d*
	M (*SD*); 95% CI	*M* (*SD*); 95% CI			
Intentional encoding Truth Tellers					
Overall detail	240.00 (98.75), 95% CI [204.45, 279.18]	179.48 (73.09), 95% CI [152.17, 208.57]	-2.463	0.017*	0.70
Total correct detail	216.32 (89.09), 95% CI [184.48, 251.86]	153.56 (58.32), 95% CI [131.89, 176.48]	-2.947	0.005**	0.83
Total incorrect detail	23.68 (13.31), 95% CI [18.68, 28.82]	25.92 (18.05), 95% CI [18.96, 32.96]	0.189	0.620	0.14
Percentage of correct detail	90.28% (3.44), 95% CI [88.93, 91.67]	86.78% (6.42), 95% CI [84.24, 89.46]	-2.402	0.020*	0.68
Incidental encoding Truth Tellers					
Overall detail	185.28 (80.91), 95% CI [154.32, 216.08]	149.40 (67.09), 95% CI [120.62, 175.74]	-1.707	0.094	0.48
Total correct detail	151.84 (53.50), 95% CI [131.05, 170.86]	118.44 (50.82), 95% CI [95.67, 138.71]	-2.263	0.028*	0.64
Total incorrect detail	33.44 (50.15), 95% CI [18.81, 57.09]	30.96 (18.07), 95% CI [23.40, 37.71]	-.233	0.817	0.07
Percentage of correct detail	83.90% (11.68), 95% CI [78.57, 87.76]	80.44% (6.36), 95% CI [78.13, 82.93]	-1.299	0.200	0.37
Intentional encoding Liars					
Overall detail	148.40 (48.68), 95% CI [129.12, 168.36]	160.92 (84.42), 95% CI [128.90, 196.73]	0.642	0.524	0.18
Total correct detail	95.52 (30.15), 95% CI [84.05, 107.73]	96.28 (34.31), 95% CI [83.75, 110.95]	0.083	0.934	0.02
Total incorrect detail	52.88 (21.57), 95% CI [44.44, 62.04]	64.64 (65.51), 95% CI [41.82, 92.40]	0.853	0.398	0.24
Percentage of correct detail	64.81% (5.70), 95% CI [62.38, 67.15]	65.71% (15.34), 95% CI [59.57, 71.95]	.273	0.786	0.08

* *p*<0.05; ** *p*<0.01; *** *p*<0.00

Table 2

Classificatory Rates for Overall Detail as a Function of Veracity and Interview Time

	Intentional encoding Truth Teller (%)	Incidental encoding Truth Teller (%)	Intentional encoding Liar (%)	Total (%)
Immediate condition	**56.0**	**29.2**	**76.0**	**54.1**
Delay condition	52.0	56.0	8.0	38.7

Note. Accuracy rates from significant discriminate functions appear in **bold**.

Table 3. *Reported Strategies before the Interview as a Function of Interview Time and Veracity.*

	Liars (_n_=50)			**Truth Tellers (_n_=99)**	
Developed Strategy	Frequency[†]	Percentage of total condition n^*	Developed strategy	Frequency	Percentage of total condition n^*
Immediate (_n_=25)			**Immediate (n=49)**		
Embed lies	16	64.0	Just 'tell the truth'	18	36.7
Report lots of details	10	40.0	Provide as many details as possible	6	12.2
Keep it simple	6	24.0			
Pause to simulate remembering	2	8.0	Be confident	2	4.1
			Be calm and friendly	2	4.1
Pretend not to remember	2	8.0	Take time to answer	3	6.1
Don't admit to not remembering	2	8.0	Admit when can't remember	2	4.1
Give minimal detail	0	0.0	Don't require a strategy as I am telling the truth	31	63.3
Delay (_n_=25)			**Delay (n=50)**		
Embed lies	13	52.0	Just 'tell the truth'	18	36.0
Report lots of detail	4	16.0	Provide as many details as possible	8	16.0
Keep it simple	0	0.0			

Pause to simulate	0	0.0	Be confident	0	0.0
remembering			Be calm and friendly	7	14.0
			Take time to answer	0	0.0
Pretend to not remember	4	16.0	Admit when can't	1	2.0
Don't admit to not			remember		
remembering	0	0.0	Don't require a strategy as	30	60.0
Give minimal detail	2	8.0	I am telling the truth		

† The sum exceeds 100.0% as each individual liar could contribute more than one strategy.

* Indicates the percentage of all liars (per experimental condition) who reported this specific strategy.

APPENDIX 1. The social exchange in the waiting room

Once the participant enters the waiting room they will find another participant already sat there, in reality it will be a confederate B (CB). After one minute another participant (confederate A, CA) enters the room and an exchange between the two confederates will occur, their conversation will be briefly interrupted by another confederate (confederate C, CC) as follows:

CA) "Hiya, how are you?"

CB) "Ah not too bad thanks you?"

CA) "Yeah all good, are you still doing chemistry? I haven't seen you for a while."

CB) "No I do physics so I only share the 'thermodynamics' module from chemistry"

CA) "Oh, that's why then, I was ill and missed the last lecture on that …don't suppose you have notes do you?"

CB) "Yeah sure, in fact I may have them here (rummages in bag) but I'll need them back? (At this point confederate C enters, looks around the room and says " Oh I'm sorry I was looking for Zarah, ill see if she's in the other lab" and then leaves) CB continues talking "Perhaps you can photo copy them after this?"   Finds and gives notes to CA.

CA) Great! Thanks, I'll photocopy them as soon as I've finished this and bring them back to you is that OK?

CB) Yeah fine

APPENDIX 2. The interview protocol

1. Please tell me everything that happened while you were waiting to be interviewed. Please start from the moment you entered the waiting room.

2. Now, I'd like you to focus upon telling me what the other people looked like. Attempt to describe them in enough detail so I could recognise them, but remember, <u>do not guess any information</u>. What did the others look like?

3. OK, still focusing upon the other people's appearance, can you describe for me in as much detail as possible what the other people where wearing?

4. Great. Now, I'm interested in what the other people said to each other. Try and remember, in as much detail as possible, what they said to each other whilst you waited. Even fragments of their conversation can be valuable so don't leave out any detail, even it appears irrelevant.'

5. So, I need you describe for me where the others were sat in the waiting room. Please describe where the others were sat relative to where you where sitting.

I'm now going to ask you questions about the spy device in the video

6. Please tell me, in as much detail as possible, what the device in the video looked like.

7. Now I need you to recall for me everything you can remember that the device could do. Try and remember, in as much detail as possible, what they said its functions where.

8. Finally, I need you to tell me where the device is going to be planted; please give me as much information about this location as you can recall.

APPENDIX 3. Condition Instructions

LIARS

You are in the 'red' team but you will be interviewed by a member of the opposing blue team and as such it is important that you mislead the interviewer about certain details of the video, including what the device looked like and could do and also the location that is chosen to plant the device. The interviewer knows that the device would be placed somewhere, but does not know where. So, above all, you must *not* reveal the location that was selected to hide the spy device and your objective is to mislead the investigator by using the third location mentioned in the video as the location that was selected to plant the device.

You also need to mislead the interviewer about the device. The interviewer knows something about the device but does not have all the details, and it is not clear what the interviewer knows. Because of this, you need to provide *some truthful* and *some false* information about the device. This will help you to appear cooperative without having to tell the interviewer everything.

In addition, you should be mindful as to what other Red team members may be doing. If you encounter anyone that uses the word 'thermodynamics' this means that those people are also on the Red team. In all likelihood, the interviewer is aware that they are around, so no point to deny that if you see them. However, you should protect them by not telling the truth about what they looked like and what they said.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened today.

Immediate condition: After watching the video the participants will be told:

You are in the 'red' team but you will be interviewed by a member of the opposing blue team about the video and the exchange between the two people in the waiting

room. As such it is important that you mislead the interviewer about certain details of the video, including what the device looked like and could do and also the location that is chosen to plant the device.

The interviewer knows that the device would be placed somewhere, but does not know where. So, above all, you must *not* reveal the location that was selected to hide the spy device and your objective is to mislead the investigator by using the third location mentioned in the video as the location that was selected to plant the device.

You also need to mislead the interviewer about the device. The interviewer knows something about the device but does not have all the details, and it is not clear what the interviewer knows. Because of this, you need to provide *some truthful* and *some false* information about the device. This will help you to appear cooperative without having to tell the interviewer everything.

In addition, you witnessed in the waiting room an encounter with two members of the Red team prior to watching the video. In all likelihood, the interviewer is aware that they were around, so no point to deny that you saw them. However, you should protect them by not telling the truth about what they looked like and what they said.

Delay condition: After arriving three weeks later they will be told:

You are in the 'red' team but you will be interviewed by a member of the opposing blue team about the video and the exchange between the two people in the waiting room. As such it is important that you mislead the interviewer about certain details of the video, including what the device looked like and could do and also the location that is chosen to plant the device.

The interviewer knows that the device would be placed somewhere, but does not know where. So, above all, you must *not* reveal the location that was selected to hide the spy device and your objective is to mislead the investigator by using the third location mentioned in the video as the location that was selected to plant the device.

You also need to mislead the interviewer about the device. The interviewer knows something about the device but does not have all the details, and it is not clear what the interviewer knows. Because of this, you need to provide *some truthful* and *some false* information about the device. This will help you to appear cooperative without having to tell the interviewer everything.

In addition, you witnessed in the waiting room an encounter with two members of the Red team prior to watching the video. In all likelihood, the interviewer is aware that they were around, so no point to deny that you saw them. However, you should protect them by not telling the truth about what they looked like and what they said.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened on that day.

INTENTIONAL ENCODING TRUTH TELLERS

You are in the 'Blue' team and you will be interviewed by a member of your team so it is important that you are totally truthful to the interviewer and provide as much information as you can recall. Note that there are also participants on the Red team about today and you should be mindful as to what other teams' members may be doing. If you encounter anyone that uses the words 'Rocket Science' this means that those people are also on your 'Blue' team, if you do not hear those words then they are members of the opposing team and you need to watch out for anything they do as that may be useful to your Blue team.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened today.

<u>Immediate condition</u>: After watching the video participants will be told:

You are in the 'Blue' team and you will be interviewed by a member of your team so it is important that you are totally truthful to the interviewer and provide as much information as you can recall about the exchange between the two people in the waiting room and about the video.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened on that day.

<u>Delay condition</u>: After arriving three weeks later they will be told:

You are in the 'Blue' team and you will be interviewed by a member of your team so it is important that you are totally truthful to the interviewer and provide as much information as you can recall about the exchange between the two people in the waiting room and about the video.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened on that day.

INCIDENTAL ENCODING TRUTH TELLERS

You are in the 'Blue' team and you will be interviewed by a member of your team so it is important that you are totally truthful to the interviewer and provide as much information as you can recall.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened today.

Immediate condition: After watching the video participants will be told:

You are in the 'Blue' team and you will be interviewed by a member of your team so it is important that you are totally truthful to the interviewer and provide as much information as you can recall about the exchange between the two people in the waiting room and about the video.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize money. If you do not appear cooperative, you will be asked to write a statement about what happened on that day.

Delay condition: After arriving three weeks later they will be told:

You are in the 'Blue' team and you will be interviewed by a member of your team so it is important that you are totally truthful to the interviewer and provide as much information as you can recall about the exchange between the two people in the waiting room and about the video.

It is important to appear cooperative. If the interviewer believes you are cooperative you earn £10. In addition, you will be entered into a draw to win up to £150 in prize

money. If you do not appear cooperative, you will be asked to write a statement about what happened on that day.

Supplementary analyses file:

Manipulation checks

    Motivation.

The overwhelming majority of participants (140 of 149) indicated that they were highly motivated to perform well during the interview (score of 6 or higher on the 7-point Likert scale, whereby 1 indicated 'not at all motivated' and 7 indicted 'extremely motivated') ($M = 6.46$; $SD = 0.66$, 95% CI [6.36, 6.57]). A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) showed no main effects (or interaction effects) of condition on motivation, all $F's < 0.94$, all $p's > 0.39$.

    Preparation.

A logistic regression was performed to examine the effects of Veracity (intentional truth teller vs. incidental truth teller vs. intentional liar) and Interview Time (immediate vs. delayed) on the participant's acceptance or rejection of additional preparation time. The logistic regression model was statistically significant $\chi^2(3) = 22.022$, $p > .001$. The model explained 18.3% (Nagelkerke's R^2) of the variance of accepting preparation time and correctly classified 67.1% of all cases (50.7% of those accepting preparation time and 83.8% of those rejecting preparation time). Incidental truth tellers were .196 times (95% CI [.082, .469]) less likely to accept preparation time than intentional liars ($p < .001$). Intentional truth tellers were .175 (95% CI [.073, .419]) times less likely to accept preparation time than intentional liars ($p < .001$). Interview time was not a significant predictor ($p = .246$).

    Length of accounts.

On average, participants disclosed 590.23 words (*SD* = 255.52, 95% CI [547.82, 631.09]). A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) showed no significant effect, all *F's* < 2.70, all *p's* > 0.10. Therefore, further analyses do not need to include word count as a covariant.

Reported spatial, temporal and perceptual detail

Spatial details

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted using spatial detail reported as the dependent variable. This analysis revealed a main effect for Veracity, $F(2,143)$= 7.374, MSE= 2932.267, $p = 0.001$, η_p^2 = .09. Scheffe tests revealed that truth tellers in the intentional encoding condition (*M* = 38.60, *SD* = 28.18, 95% CI [33.03, 44.18]) reported significantly more spatial detail than both truth tellers in the incidental encoding condition (*M* = 29.12, *SD* = 17.68, 95% CI [23.49, 34.75]) and liars (*M* = 23.44, *SD* = 13.27, 95% CI [17.87, 29.02]). The difference between truth tellers in the incidental condition and liars was not statistically significant. The analysis also revealed a Main effect Interviewing Time, $F(1,143)$= 6.234, MSE= 2479.064, $p = 0.014$, η_p^2 = .04. Participants in the Immediate condition reported more spatial detail (*M* = 34.47, *SD* = 26.31, 95% CI [29.88, 39.05]) than participants in the Delay condition (*M* = 26.31, *SD* = 14.44, 95% CI [21.76, 30.86]). The Interview Time X Veracity interaction was also significant, $F(2,143)$= 4.035, MSE= 1604.696, $p = 0.020$, η_p^2 = .05.

As Table 4 shows, truth tellers in the intentional condition in the immediate interviewing condition reported more spatial detail than truth tellers in the intentional condition in the delay interviewing condition. Truth tellers in the incidental condition

in the immediate interviewing condition reported more spatial detail than truth tellers in the incidental encoding condition in the delay interviewing condition. No difference emerged for the number of spatial details reported by liars in the immediate interviewing condition and liars in the delay interviewing condition.

Temporal details

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted using temporal detail reported as the dependent variable. This analysis revealed a main effect for Veracity, $F(2,143)= 7.242$, MSE= 528.412, $p = 0.001$, $\eta_p^2 =$ .09. Scheffe tests revealed that liars ($M= 9.34$, $SD = 6.90$, 95% CI [6.95, 11.73]) reported significantly fewer temporal details than both truth tellers in the intentional encoding condition ($M=15.70$, $SD = 10.28$, 95% CI [13.31, 18.09]) and truth tellers in the incidental encoding condition ($M= 13.70$, $SD= 8.17$, 95% CI [11.29, 16.11]). The difference between truth tellers in the incidental condition and truth tellers in the in intentional condition was not statistically significant. The main effect for Interviewing Time was not significant, $F(1,143)= 0.123$, MSE= 9.003, $p = 0.726$, $\eta_p^2 = .001$. Furthermore, the Interview Time X Veracity interaction was not significant, $F(2,143)= 1.861$, MSE= 135.784, $p = 0.159$, $\eta_p^2 = .03$.

Perceptual details

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted using perceptual detail reported as the dependent variable. This analysis revealed a main effect Veracity, $F(2,143)= 7.516$, MSE= 18498.963, $p = 0.001$, $\eta_p^2 =$ .10. Scheffe tests revealed that truth tellers in the intentional condition ($M = 159.96$, $SD = 59.44$, 95% CI [146.09, 173.83]) reported significantly more perceptual detail

than both truth tellers in the incidental condition ($M = 131.78$, $SD= 47.35$, 95% CI [117.77, 145.80]) and liars ($M = 123.16$, $SD = 42.74$, 95% CI [109.29, 137.03]). The difference between truth tellers in the incidental condition and liars was not statistically significant. The analysis also revealed a main effect for Interviewing time, $F(1,143)= 3.972$, MSE= 9776.980, $p = 0.048$, $\eta_p^2 = .03$. Participants in the Immediate interviewing condition reported more perceptual detail ($M = 146.40$, $SD = 50.68$, 95% CI [135.00, 157.81]) than participants in the Delay condition (130.20, SD= 53.27, 95% CI [118.88, 141.52]). The Interview Time X Veracity interaction was not significant, $F(2,143)= 1.728$, MSE= 4254.273, $p = 0.181$, $\eta_p^2 = .02$.

Percentage of correct spatial details

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted using the percentage of correct spatial details reported as the dependent variable. This analysis revealed a main effect Veracity, $F(2,143)= 57.155$, MSE= 0.513, $p < 0.001$, $\eta_p^2 = .44$. Scheffe tests revealed that liars ($M= 75.77$, $SD = 14.22$, 95% CI [73.1, 78.4]) reported a significantly lower percentage of correct spatial detail than both truth tellers in the intentional condition ($M=94.78$, $SD = 5.57$, 95% CI [92.1, 97.4]) and truth tellers in the incidental condition ($M=91.36$, $SD= 6.80$, 95% CI [88.7, 94.0]). The difference between truth tellers in the intentional condition and truth tellers in the incidental condition was not statistically significant. The analysis also revealed a main effect Interviewing Time, $F(1,143)= 4.527$, MSE= 0.041, $p = 0.035$, $\eta_p^2 = .03$. Participants in the Immediate condition reported a higher percentage of correct spatial detail ($M=89.92$, $SD = 10.87$, 95% CI [86.8, 89.0]) compared to participants in the Delay condition ($M= 85.65$, $SD = 14.18$, 95% CI [83.5, 87.8]. The Interview Time X Veracity interaction was not significant, $F(2,143)= 2.201$, MSE=

0.020, $p = 0.114$, $\eta_p^2 = .03$.

Percentage of correct temporal details

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted using the percentage of correct temporal details reported as the dependent variable. This analysis revealed a main effect Veracity, $F(2,143)= 28.314$, MSE= 0.563, $p < 0.001$, $\eta_p^2 = .28$. Scheffe tests revealed that liars ($M= 73.07$, $SD = 16.84$, 95% CI [69.1, 77.0]) reported a significantly lower percentage of correct temporal details than both truth tellers in the intentional condition ($M=93.62$, $SD = 7.15$, 95% CI [89.7, 97.6]) and truth tellers in the incidental condition ($M=88.00$, $SD= 16.00$, 95% CI [84.0, 92.0]). The difference between truth tellers in the intentional condition and truth tellers in the incidental condition was not statistically significant. The main effect for Interviewing Time was not significant, $F(1,143)= 0.254$, MSE= 0.005, $p = 0.615$, $\eta_p^2 = .002$. Furthermore, the Interview Time X Veracity interaction was not significant, $F(2,143)= 0.454$, MSE= 0.009, $p = 0.636$, $\eta_p^2 = .01$.

Percentage of correct perceptual details

A 3 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) was conducted using the percentage of correct perceptual details reported as the dependent variable. This analysis revealed a main effect Veracity, $F(2,143)= 135.126$, MSE= 0.800, $p < 0.001$, $\eta_p^2 = .65$. Scheffe tests revealed that liars ($M= 56.9$, $SD = 8.48$, 95% CI [54.8, 59.1]) reported a significantly lower percentage of correct perceptual detail than both truth tellers in the intentional condition ($M=81.9$, $SD = 8.27$, 95% CI [79.8, 84.1]) and truth tellers in the incidental condition ($M = 73.0$, $SD = 8.03$, 95% CI [70.8, 75.2]). Truth tellers in the intentional condition reported a higher percentage of correct perceptual details than truth tellers in the incidental condition. The analysis also revealed a main effect for Interview Time, $F(1,143)= 23.636$, MSE= 0.140, $p <$

0.001, $\eta_p^2 = .14$. Participants in the Immediate interviewing condition reported a

higher percentage of correct perceptual detail ($M = 73.67$, $SD = 12.60$, 95% CI [71.9,

75.5]), compared to participants in the Delay condition ($M = 67.56$, $SD = 13.24$, 95%

CI [65.8, 69.3]). The Interview Time X Veracity interaction was not significant,

$F(2,143) = 0.877$, MSE $= 0.005$, $p = 0.418$, $\eta_p^2 = .01$

Table 4.

Spatial, temporal and perceptual detail reported for the social interaction as a function of veracity and interview time

	Immediate condition M (SD); 95% CI	Delay condition M (SD); 95% CI	*t*	*p*	*Cohen's d*
Truth Tellers in the intentional condition					
Spatial	46.48 (35.34), 95%C1 [32.85, 60.95]	30.72 (15.58), 95% CI [24.67, 37.30]	-2.040	0.049*	0.61
Temporal	16.92 (11.97), 95% CI [12.62, 22.00]	14.48 (8.33), 95% CI [11.54, 17.76]	-0.837	0.407	0.24
Perceptual	177.12 (58.30), 95% CI [155.22, 200.61]	142.80 (56.58), 95% CI [119.61, 166.28]	-2.112	0.040*	0.60
Truth Tellers in the incidental condition					
Spatial	35.92 (19.69), 95% CI [28.72, 44.53]	22.32 (12.62), 95% CI [17.22, 27.21]	-2.890	0.006**	0.82
Temporal	14.88 (7.84), 95% CI [11.77, 18.03]	12.52 (8.46), 95% CI [9.63,15.78]	-1.009	0.318	0.29
Perceptual	140.21 (36.99), 95% CI [125.65, 154.50]	123.36 (55.03), 95% CI [101.09, 146.16]	-1.253	0.217	0.36
Liars in the intentional condition					
Spatial	21.00 (11.98), 95% CI [16.44, 26.50]	25.88 (14.28), 95% CI [20.47, 31.68]	1.309	0.197	0.37
Temporal	7.68 (3.54), 95% CI [6.38, 9.17]	11.00 (8.89), 95% CI [7.86, 14.57]	1.735	0.093	0.49
Perceptual	121.88 (38.14), 95% CI [107.28, 136.37]	124.44 (47.66), 95% CI [104.92, 143.83]	0.210	0.835	0.06

* *p*<0.05; ** *p*<0.01; *** *p*<0.001

Table 5.

Percentage of correct spatial, temporal and perceptual detail reported for the social interaction as a function of veracity and interview time

	Immediate condition M (SD); 95% CI	Delay condition M (SD); 95% CI	*t*	*p*	*Cohen's d*
Truth Tellers in the intentional condition					
Spatial	95.50% (4.77), 95%C1 [93.53, 97.36]	94.07% (6.27), 95% CI [91.44, 96.42]	-0.906	0.369	0.26
Temporal	91.73% (8.04), 95% CI [88.65, 94.75]	95.51% (5.69), 95% CI [93.31, 97.50]	1.921	0.061	0.54
Perceptual	86.94% (5.23), 95% CI [83.83, 88.25]	77.76% (8.75), 95% CI [74.26, 80.92]	-4.061	0.001***	1.27
Truth Tellers in the incidental condition					
Spatial	91.67% (5.92), 95% CI [89.14, 93.89]	91.07% (7.67), 95% CI [88.08, 94.14]	-0.306	0.761	0.09
Temporal	87.33% (10.14), 95% CI [83.21, 91.14]	88.63% (20.31), 95% CI [79.37, 95.32]	0.281	0.780	0.08
Perceptual	75.21% (7.44), 95% CI [72.16, 78.27]	70.92% (8.18), 95% CI [67.83, 74.18]	-1.879	0.067	0.55
Liars in the intentional condition					
Spatial	79.71% (12.71), 95% CI [74.47, 84.28]	71.83% (14.79), 95% CI [66.29, 77.52]	-2.020	0.049*	0.57
Temporal	73.86% (17.46), 95% CI [67.27, 81.10]	72.27% (16.52), 95% CI [65.16, 78.66]	-0.331	0.742	0.09
Perceptual	59.90% (6.58), 95% CI [57.22, 62.46]	54.00% (9.24), 95% CI [50.58, 57.61]	-2.602	0.012*	0.74

* *p*<0.05; ** *p*<0.01; *** *p*<0.001.

Classification rates for truth tellers and liars in the intentional encoding

conditions

We additionally ran two discriminant analyses in which we compared only truth

tellers in the intentional encoding condition and liar veracity groups (leaving out the

truth tellers in the incidental encoding condition), again for the immediate and delay

conditions separately. In both cases, the objective Veracity group belonging (truth

tellers in the intentional condition or liar) was the classifying variable and overall

reported detail was the predictor. A significant discriminant function emerged for

distinguishing between truth tellers in the intentional condition and liars in the

immediate interviewing condition, $\chi^2(1) = 26.93$, Wilks' $\lambda = 0.57$, $p < 0.001$

(canonical correlation was .66). The function correctly classified 80.0% of the truth

tellers in the intentional condition and 68.0% of the liars resulting in an overall total

accuracy rate of 74.0% of participants. The discriminate analysis for distinguishing

between truth tellers in the intentional condition and liars in the delay condition was

not significant, $\chi^2(1) = 0.900$, Wilks' $\lambda = 0.981$, $p = 0.343$ (canonical correlation was

.0.137).