A stability bias effect amongst deceivers

Adam Charles Harvey*

Department of Psychology, University of Portsmouth

Aldert Vrij

Department of Psychology, University of Portsmouth

Lorraine Hope

Department of Psychology, University of Portsmouth

Sharon Leal

Department of Psychology, University of Portsmouth

Samantha Mann

Department of Psychology, University of Portsmouth

*Correspondence concerning this article should be addressed to Adam C. Harvey, University of Portsmouth, Department of Psychology, King Henry Building, King Henry Street, Portsmouth PO1 2DY, Portsmouth, United Kingdom. Email: adam.harvey@port.ac.uk

This work is funded by the High-Value Detainee Interrogation Group, DJF-15-1200- V-0010196 awarded to the University of Portsmouth (UK). Any opinions, findings, conclusions, or recommendations expressed in this article are those of the authors and do not necessarily reflect the views of the U.S. Government.

Abstract

Research examining how truth tellers' and liars' verbal behaviour is attenuated as a function of delay is largely absent from the literature, despite its important applied value. We examined this factor across two studies in which we examined the effects of a hypothetical delay (Experiment 1) or actual delay (Experiment 2) on liars' accounts. In Experiment 1 – an insurance claim interview setting – claimants either genuinely experienced a (staged) loss of a tablet device (n=40), or pretended to have experienced the same loss (n=40). Truth tellers were interviewed either immediately after the loss (n=20) or three weeks after the loss (n=20), whereas liars had to either pretend the loss occurred either immediately prior (n=20) or 3-weeks prior (n=20) to the interview (i.e., hypothetical delay for liars). In Experiment 2 – a Human Intelligence gathering setting – sources had to either lie (n=50) or tell the truth (n=50) about a secret video they had seen concerning the placing of a spy device. Half of the truth tellers and liars where interviewed immediately after watching the video (n=50), and half where interviewed three-weeks later (n=50) (i.e., real delay for liars). Across both experiments, truth tellers interviewed after a delay reported fewer details than truth tellers interviewed immediately after the to-be-remembered event. In both studies, liars failed to simulate this pattern of forgetting and reported similar amounts of detail when interviewed without or after a delay, demonstrating a stability bias in reporting.

Key words: Lie-detection, forgetting, richness of detail, stability bias, verbal-strategies, verbal credibility cue

Public significance statement

Across two studies we explored whether liars can take into account the tendency for information to be lost from honest individual's memory over time (forgetting). Across both studies results were highly similar. Regardless whether liars incorporated a delay into their statements using their imagination (Study 1) or could use an actual experience (Study 2), they failed to feign the effects of forgetting.

A stability bias effect amongst deceivers

In most deception experiments, truth tellers and liars are typically interviewed immediately after experiencing some target event (Vrij, 2008). In such contexts, truth tellers typically report statements richer in detail than liars (e.g. Amado, Arce, Fariña, & Vilarino, 2016; Masip, Sporer, Garrido & Herrero, 2005; Oberlader, Naefgen, Koppehele-Gossel, Quinten, Banse, & Schmidt, 2016). Clearly, this may not reflect all applied settings as interviews can occur weeks after a critical event (Gabbert, Hope & Fisher, 2009). Whereas the memory literature predicts that truth tellers (retrieving information from memory) will forget details over time (e.g. Anderson, 1983; Ebbinghaus, 1885; Wixted & Ebbesen, 1997), it is unclear how such delays will alter liars' verbal behaviour (Vrij, Leal, Granhag, Mann, Fisher, Hillman & Sperry 2009). Liars must take into account the effects of forgetting when being interviewed after a delay. If truth tellers forget detail but liars do not feign such forgetting, then lie detection may be more difficult after delays. Hence after delay interval, one of the most diagnostic credibility cues typically found in research utilising immediate interviewing paradigms (e.g. 'richness of detail'; Amado, Arce, Fariña, & Vilarino, 2016; Vrij, 2005, 2008, 2015) may be undiagnostic.

To advance the deception literature to examine the effect of delayed interviewing, the aim of the current two experiments was to examine how the verbal content of liars and truth tellers varies as a function of delay. Specifically, we test the hypothesis that liars commit a metacognitive error when lying across time (e.g. Lancaster, 2011; Vrij et al., 2009) and, as a result, display a *stability bias* (Kornell & Bjork, 2009; see Koriat, Bjork, Sheffer & Bar, 2004): A failure to accurately calibrate their verbal output to take account of well-established patterns of forgetting over delay (e.g. Ebbinghaus, 1885; Wixted, 1990, 2004; Wixted & Carpenter, 2007).

Lying about the past

When lying about the past, individuals may generate scripts from their *imagination* (e.g. Vrij, 2008; see Johnson & Raye, 1998; Johnson, Foley, Suengas & Raye, 1988). On such occasions, the reported outright fabrication (e.g. a bold-faced-lie; McCornack, Morrison, Paik, Wisner & Zhu, 2014) will never have actually occurred and the fabricated account is not based upon a previous experience or recall (e.g. a fabricated loss of an insured object). If this fabricated event supposedly occurred weeks previous to an interview, liars face a challenge. As items in memory become less accessible over time (Anderson, 1983; Ayers & Reder, 1998), liars must attempt to calibrate their verbal output to match the level of detail typically expected of truth tellers. The loss of information from memory occurs rapidly at first before plateauing, a pattern known as the 'forgetting curve' (Ebbinghaus, 1885; see Murre & Dros, 2015), but estimating the appropriate degree of forgetting to simulate the actual recall of a truth teller is not an easy task for liars.

Error in such a calibration may involve underestimation or overestimation of the appropriate level of detail to report. Theoretically, we argue that for two reasons liars may be particularly susceptible to *overestimating* the quantity of details to report after a delay. First, research shows individuals typically display a stability bias and underestimate the degree of forgetting across time (Kornell & Bjork, 2009; Koriat, Bjork, Sheffer & Bar, 2004). Thus, it is plausible that liars who fabricate an incident purported to have occurred weeks previous to an interview would display a stability bias by virtue of an *inability* to accurately estimate genuine recall after a delay. Second, unlike truth tellers who tend to take their credibility as self-evident (Gilovich, Savitsky, & Medvec, 1998; Jordan & Hartwig, 2013), liars are motivated to convey an honest impression (e.g. Köhnken, 1989, 1996, 2004). To maximise their chance of being judged as credible, they typically strive to provide statements rich in detail (Hartwig et al., 2007; Nahari, Vrij et al., 2012; Masip & Herrero, 2013; Strömwall et al., 2006), as such detailed statements are more likely to be judged as credible (Bell & Loftus,

1989; Johnson, 2006; Johnson, Foley, Suengas, & Raye, 1988). Thus, liars may display a stability bias by virtue of being *unwilling* to reduce the detail contained within their statements after a delay to below a threshold considered necessary to appear genuine.

For liars, accurately estimating the appropriate extent of forgetting after a delay requires metacognition generally (i.e. cognition regarding mental processes; Flavell, 1979) and the use of metamemory specifically (i.e. judgements and beliefs about memory; Kornell, Rhodes, Castel & Tauber, 2011). According to the dual view of metacognitive judgements derived from the Cue Utilization Approach (Koriat, 1997; Koriat et al., 2004; Kornell et al., 2009), theory-based judgements can be distinguished from experience-based judgements. The former requires the explicit application of theory and belief (i.e. knowledge about memory decay across time), whist the latter utilizes processing of actual items in memory (i.e. strength and precision of genuine recollection). An outright simulation of a delay interval (i.e. in cases where the delay is feigned by liars) forces liars to utilize their beliefs and knowledge about the rate of forgetting across time. A practical example of this is any lie about past events that never occurred (i.e. there exists no past event to base the deception upon or embed the fabrication within). Correctly estimating the appropriate extent of memory decay to feign requires liars apply theory-based beliefs about memory. Thus, investigating how accurately liars employ their metacognitive knowledge is important for extending the deception literature to include lies told after delay intervals.

In Experiment 1 truth tellers experienced an event and were interviewed about it immediately afterwards or with a three-week delay. Liars did not experience the event but were asked to pretend to have experienced it either just before, or three weeks before, the interview. In line with previous research (e.g. Amado et al., 2016; Vrij, 2005, 2008, 2015) we expect truth tellers to provide more detail than liars when interviewed immediately (i.e. without a delay interval). This difference in reported detail is attributed to liars' lack of

imagination to tell a detailed, plausible, story (Köhnken, 1989, 1996, 2004) or to liars' reluctancy to report lots of detail out of fear that any information they provide will give possible leads to investigators (Masip & Herrero, 2013; Nahari, Vrij, & Fisher, 2014). Individual's beliefs regarding memory's permanence are frequently incorrect (Magnussen et al., 2006; Ost et al., 2016). The performance of memory across time is often overestimated (Legaut & Laurence, 2007; Loftus & Loftus, 1980; Simons & Chabris, 2011). Plausibly, liars may miscalibrate the appropriate quantity of detail to provide after a simulated delay interval and thus commit a metacognitive error (Vrij et al., 2009).

Based upon the previous theoretical considerations, we predict that liars will display a stability bias (Koriat et al., 2004; Kornell et al., 2009). We predict that the amount of detail reported by liars will not vary as a function of delay interval, compared to truth tellers who will display forgetting across delay interval (Hypothesis 1). If the quantity of detail reported by truth teller's decreases (due to forgetting) across delay, and the quantity of detail reported by liars remains constant (due to a stability bias; Hypothesis 1), it can be predicted that the difference in reported detail between truth tellers and liars will be more pronounced in the immediate condition than in the delay interval condition. We predict deception detection accuracy to be greater in the immediate interviewing condition compared to the delay interval condition (Hypothesis 2).

Experiment 1

Method

Design

A 2 (Veracity: Truth teller vs. Liar) x 2 (Interview Time: Immediate vs. Delay) between subject design was used with the quantity of details provided as the dependent measure.

Ethics

A favorable ethical review decision was given, prior to the research, by the Science Faculty Ethics Committee (SFEC) (reference SFEC 2014-082), University of Portsmouth, UK. All participants' rights where protected during the study.

Participants

A total of 80 volunteers (52 females), aged between 18 and 41 years (M = 21.26 years, SD = 3.89, 95% CI [20.39, 22.15]), from the University's undergraduate, postgraduate, and staff, communities, participated in the experiment.

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 experiment was about detecting deception within an insurance setting. Each participant was given an information sheet about the study and informed written consent was obtained.

Upon obtaining informed consent, all participants were randomly allocated to either the truth teller (n = 40) or liar (n = 40) Veracity conditions. Half of the liars and half of the truth tellers where then randomly allocated to either the delay (n = 40) or the immediate (n = 40) Interviewing Condition, resulting in 20 participants per cell.

Both liars and truth tellers were told that the study involved lie detection in an insurance claim setting. Truth tellers (n=40) were informed that the first phase of the study (Phase 1) would take place at a local bar, approximately 200 meters from the department. Truth tellers were informed that they may experience a staged 'loss' (i.e. theft) of a tablet device from this location and that they would be asked to honestly report during an interview what they could recall about the incident. In contrast, liars (n=40) where informed their task was to *pretend* they were truth tellers and to convince an interviewer they experienced the loss of the tablet at a local bar (i.e. that they had experienced the truth teller's scenario). As

the truth tellers task was scripted and staged with confederates, liars where provided a description of this scenario.

Truth tellers, accompanied by the experimenter, collected a tablet device from the technology support office. Participants were then escorted to the local bar where they were intercepted by a confederate posing as a PhD student. The PhD student explained that he required assistance from the researcher regarding a manuscript. The experimenter explained that he was running a study but suggested that the confederate join him and the participant at the bar. No participant objected. Once inside, the participant, experimenter and confederate sat in a pre-determined location from which it was not possible to see the bar area. The participant was handed the tablet device and instructed to open an app (for the study). Deliberately, the tablet device was not charged and so the participant found that they were not able to open the app due to low battery levels. The experimenter then suggested taking it to the bar and asking the bar staff if it could be charged. The participant always accompanied the experimenter to the bar and witnessed the bar staff (also confederates) accepting the device and taking it out of sight (into a staff room) to be 'charged'. In reality, the device was placed in a satchel for later collection. Taking some drinks back to the table, the experimenter then read the confederate's manuscript, whist the participant and confederate played three rounds of a popular game (ConnectFour). After 15 minutes, the participant and experimenter returned to collect the device to be told it had already been taken by someone the staff assumed was a member of the research team. The confederate and participant were asked if they had seen anything (nobody reported seeing anything which is unsurprising as they could not have seen anything given the position of the table in relation to the bar). The experimenter then said that they should return to the department to explain what happened.

Truthful participants in the delay condition were told that they had completed the first phase of the study. Contact details were taken and dates and times were confirmed for these

participants to return three-weeks later. On their return after three weeks, participants in the delay condition progressed to Phase 2 of the experiment.

Truthful participants in the immediate condition progressed immediately to Phase 2 of the experiment. At the outset, all truth tellers were told they would be interviewed about the loss of the department's tablet device. Before the interview, truth tellers were reminded they should be totally truthful to the interviewer and provide them with as much information about the incident as they can recall.

The task for liars was necessarily different to that of truth tellers. Liars did not go to the bar with the experimenter. Instead all liars were provided a description of the truth teller's scenario, including photos of the experimenter, the confederate from the bar and the tablet device, together with a map indicating their route (see Appendix 1). Liars were told they were free to report any information they deemed necessary to convince the interviewer they were telling the truth. Furthermore, liars were instructed that their task was to convince an interviewer (who did not know if they were lying or telling the truth) they were truth tellers and had actually experienced the loss of the tablet device. As such, liars had to *pretend* to have suffered a loss they never actually experienced.

Half the liars were informed it was critical they pretended the incident occurred immediately before being interviewed. This was justified by explaining that truth tellers had also experienced the loss immediately prior to the interview. The other half the liars (n=20) were informed it was critical they pretended the incident occurred three weeks prior to the interview. They were informed that this was because truth tellers had experienced the loss three weeks prior to the interview.

All participants (liars and truth tellers) were told that if the interviewer judged them as truthful, they would receive £5. In addition, participants who were rated as truthful by the interviewer would be entered into a prize draw to win up to £150 in prize money. However, if

participants where judged to be untruthful, they would instead be asked to write a statement about what happened during the study. In reality, in addition to the standard compensation (£5), all participants (irrespective of condition or performance in the interview) were entered into the prize draw and none were required to write a statement. Three winners of the prize draw were randomly selected and awarded £150, £75 and £50.

All participants where offered as much preparation time as they required prior to the interview. Liars in the 'immediate' condition where reminded they should deceive the interviewer and pretend the incident occurred immediately prior to the interview, whereas liars in the 'delay' condition where reminded they should deceive the interviewer and pretend the incident occurred three-weeks prior to the interview. As such, liars provided their statement immediately after reading the experimental materials and exercising their option of preparation time. 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). Participants were interviewed on completion of the questionnaire.

The interview

At the outset of each interview, the interviewer explained that s/he understood that the department's tablet was lost either immediately before the interview (truth tellers and liars in the immediate condition) or three weeks prior to the interview (truth tellers and liars in the delay condition). The question protocol was identical for all interviews and comprised of a single free recall instruction. Participants were asked to report, in as much detail as possible, everything that happened from the moment they initially left the laboratory to the moment they realised the tablet device was missing. All interviews were audiotaped and the interviewer was blind to the veracity of the interviewees. After the interview, participants

were given a post-interview questionnaire to complete. In this questionnaire, participants were asked 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), and to report percentage of truthful information they disclosed in the interview (also on an 11-point Likert Scale, ranging from 0% to 100%). Truth tellers were asked to indicate on a 7-point Likert scale (whereby 1 denotes 'not at all' and 7 denotes 'to a great extent') how strong, precise and detailed their memory of the incident was. Liars where asked to indicate on a 7-point Likert scale (whereby 1 denotes 'not at all' and 7 denotes 'to a great extent') how strong, precise and detailed they pretended their memory of the incident to be during the interview. Upon completion participants where thanked, debriefed and compensated for their time.

Coding

All audiotaped interviews were transcribed and the coding was conducted using these transcripts. The statements were coded by one coder (blind to the experimental conditions). A frequency count method was employed rather than a response scale method (see Nahari, 2016 for alternative content analysis scoring methodology). For clarity we have provided underlined examples of the coded details. The coder scored perceptual detail (information about what was seen, heard, felt and smelt during the described activities, e.g. 'she spoke quietly'), spatial detail (information about locations or the arrangement of persons and/or objects; e.g. 'he sat next to her, to the left') and temporal detail (information about when the event happened and explicit descriptions of the sequence of various events; e.g. 'first he ordered a drink and then read her paper'). Information about objects (e.g. 'we sat down at a table') and actions (e.g. 'the waitress walked over to us') were coded and classified as examples of perceptual information. The coder was experienced and has coded verbal detail in several previous experiments carried out in this lab.

A second coder (also blind to the veracity of the statements and trained as a coder)

coded a random selection of 16 statements (20%) for all the dependent measures. Inter-rater reliabilities between the two coders for the occurrence frequency of perceptual, spatial and temporal detail were measured via intra-class correlation coefficients (ICC). The ICC was high and therefore satisfactory for total spatial details [ICC] = .81, temporal details [ICC] = .84, perceptual details [ICC] = .79 and total details (spatial, temporal and perceptual information combined, ICC = .80]. 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. As no hypotheses were formulated pertaining to different detail types, we only report the total number of details reported in the Results section (see supplementary material for additional analyses).

Results

Manipulation Checks

Veracity

Truthful participants rated their statements as being overwhelmingly based on a truthful experience, rating the majority of their statement as truthful (M = 89.25%, SD = 14.21, 95% CI [85.00, 93.57]), whereas deceptive participants rated their statement to be overwhelmingly based on fabrication (M = 13.50%, SD = 13.50, 95% CI [9.29, 18.12]), $t(78) = 24.44$ $p < 0.001$, d= 5.47, 95% CI[4.47, 6.36].

Delay

Truth tellers in the delay condition rated their memories of the critical incident as weaker, less clear and less detailed to a greater extent than truth tellers in the immediate condition, all t's > 5.31, all p's <0.001, Cohen's d > 1.68. Liars in the delay condition rated *pretending* to have weaker, more-vague and less detailed memories of the critical incident to a greater extent than liars in the immediate condition, all t's > 2.89, all p's < 0.006, all d > 0.93, see Table 1.

[Insert Table 1 about here]

Motivation

Overall, participants reported being highly motivated (*M* = 6.11, *SD* = 0.71, 95% CI [5.95, 6.26]) to perform well in the experiment. No main effect for Veracity, *F*(1,76)= .025, *p*= .876 or Interview Time *F*(1,76)= .614, *p*=.436 emerged, and the Veracity X Interview Time interaction was not significant either, *F*(1,76) = 1.991, *p*= .162.

Reported Detail

A 2 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) using overall reported detail as the dependent variable, revealed a main effect for Veracity, *F*(1,76)= 9.43, MSE = 16936.20, *p* = 0.003. A significant main effect for Interview Time also emerged, *F*(1,76)= 5.124, MSE = 9202.05, *p* = 0.026. Furthermore, the Interview Time X Veracity interaction was significant, *F*(1,76) = 11.981, MSE = 21516.80, *p* = 0.001, η_p^2 = .14.

Truth tellers in the Immediate condition (*M* = 138.55, *SD* = 55.05, 95% CI [116.09, 164.35]) reported more details than truth tellers in the Delay condition (*M* = 84.30, *SD* = 40.95, 95% CI [67.53, 102.53]), *t*(38) = 3.536, *p* = 0.001, *d* = 1.12, 95% CI [.63, 1.57]. In contrast, liars in the immediate condition (*M* = 76.65, *SD* = 33.06, 95% CI [62.88, 91.04]) and liars in the Delay condition (*M* = 88.00, *SD* = 37.20, 95% CI [72.55, 104.72]) did not differ significantly in terms of the number of details reported, *t*(38) = 1.020, *p*= 0.314, *d* = .32, 95% CI [-.12, 0.76]. This interaction effect supports Hypothesis 1.

Classification

We ran two discriminate analyses to distinguish between truthful and deceptive participants in the i) Immediate and ii) Delay interview conditions separately. In both cases, the objective Veracity group belonging (truth teller or liar) was the classifying variable and overall reported detail was the predictor. We present the cross-validated 'leave-one-out' results. A significant discriminant function emerged for distinguishing between Truth Tellers

and Liars in the Immediate interviewing condition, $\chi^2(1) = 14.930$, Wilks' $\lambda = 0.672$, $p < 0.001$, (canonical correlation was .57). This function correctly classified 80.0% of liars and 65.0% of truth tellers, resulting in an overall accuracy rate of 72.5%; see Table 2. The discriminate analysis distinguishing between Liars and Truth Tellers in the delay condition was not significant, $\chi^2(1) = 0.088$, Wilks' $\lambda = 0.999$, $p = 0.998$ (canonical correlation was 0.05). These findings support Hypothesis 2.

[Insert Table 2 about here]

Discussion

The quantity of details reported by liars did not vary as a function of interview time. Liars failed to accurately calibrate the quantity of disclosed detail to simulate the effect of forgetting across time associated with genuine memory. The observed insensitive to the delay manipulation displayed by liars suggests a stability bias affecting their verbal behaviour. Truth tellers reported more detail in the immediate interview condition versus the delay interview condition suggesting forgetting over time. The difference between liars and truth tellers in terms of detail quantity was greater in the immediate (versus delay) condition. Superior lie detection accuracy was possible in the immediate (versus the delay) interviewing condition (see Table 3). These results support both Hypothesis 1 and Hypothesis 2.

Experiment 1 forced liars to produce fabrications using their imagination (rather than perceptual experience). Indeed, liars reported very little (13.50%) of the information they disclosed as being derived from actual experience. This implies, however, that liars in our experimental scenario were forced to incorporate the effect of delay theoretically (via applying specific meta-memorial knowledge about forgetting over time).

Such a hypothetical delay may not reflect all settings. Liars typically prefer to tell 'embedded' lies (Leins, Fisher & Ross, 2013; Vrij, 2008). In such instances, liars produce fabrications using genuine memory from past experience, rather than from imagination (for

an analogous theoretical argument, see McCornack et al., 2014). For example, an individual might lie about what was said at an actual meeting. Here liars will have a genuine memory of the meeting, rather than relying on an outright fabricated script (i.e. McCornack, 1992, McCornack et al. 2014). As such, a deception about past events can manipulate information retrieved from memory.

One possibility is that lying about real past events (i.e. telling embedded lies; Leins et al., 2013; Vrij, 2008) will result in a shift in liars from analytic utilization of theory-based cues (i.e. knowledge about forgetting over time) to experienced-based cues (i.e. using the strength of genuine recollection) as a means for calibrating how much information to report after a delay (Koriat, 1997; Koriat et al., 2004; Kornell et al., 2009). This may lead liars to more accurately calibrate the level of detail to report after a delay interval as genuine memory will have (plausibly) decayed. However, calibration may still not be so easy for liars. Individuals typically display poor accuracy when estimating their own learning and others future memory performance when judgements are made in a between-subject manner (i.e. when an individual makes a single estimate regarding future memory performance; Koriat et al., 2004). In contrast, individuals appear better at estimating future memory performance when they make a series of estimates in a within-subject manner (i.e. each individual makes two or more estimates concerning future memory performance; Koriat et al., 2004). Embedding a deception in actual past memory does not transform the liars' task from being a between-subject estimate, to being a within-subject estimate. That is, even when embedding lies, liars must make a single estimate regarding memory performance. As such, the stability bias may generalise to settings that allow for embedded deceptions (Leins et al., 2013; Vrij, 2008), even when liars utilize real memory derived from an *actual* delay, and thus employ experience-based cues.

Therefore, Experiment 2 extended Experiment 1 by examining a scenario where liars experience an actual delay, rather than mentally simulating the effects of delay. In Experiment 2 we explored whether the effects observed in Experiment 1 (where liars were forced to apply theory-based cues) generalise to instances where liars can apply experience-based cues. We predict truth tellers will display forgetting across delay and liars to display a stability bias (Hypothesis 3). We further predict the difference in providing detail between truth tellers and liars will be more pronounced in the immediate condition than in the delay interval condition. As a consequence, we predict deception detection accuracy to be greater in the immediate interviewing condition compared to the delay interval condition (Hypothesis 4).

Experiment 2

Method

Design

A 2 (Veracity: Truth teller vs. Liar) x 2 (Interview Time: Immediate vs. Delay) between subject design was used with overall details (the sum total of spatial, temporal and perceptual detail combined) as the dependent measure.

Ethics

A favorable ethical review decision was given, prior to the research, by the Science Faculty Ethics Committee (SFEC) (reference SFEC 2015-059), University of Portsmouth, UK. All participants' rights where protected during the study.

Participants

A total of 100 volunteers, comprising of 68 females and 32 males, aged between 18 and 55 years (M = 24.09 years, SD = 8.51, 95% CI [22.46, 25.70]), from the University's undergraduate, postgraduate, and staff communities, participated in the experiment.

Procedure

Participants were recruited via adverts on the University's online participant pool and were informed that the experiment was about detecting deception within an intelligence setting. Participants were tested individually.

Upon obtaining informed consent, all participants were randomly allocated to either the truth teller (n = 50) or liar (n = 50) Veracity conditions. Half of the participants per group where then randomly allocated to either the delay (n = 50) or the no delay (n = 50) condition, resulting in 25 participants per cell.

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. This recording (video) has been used in previous research (Ewens et. al., 2014, 2015; Shaw et. al, 2013). 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 (n = 50) were told that for the experiment they are an intelligence operative for 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.

Liars (n = 50) were told that for the experiment they were an intelligence operative for the 'Red' team but would be interviewed by a member of the opposing 'Blue' team and as such their task was to mislead the interviewer about certain information in 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 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. Liars were also told to lie about the device itself. They 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 were told to provide some truthful and some false information about the spy device, as this would help them appear truthful without having to tell the interviewer everything.

All participants were told that if the interviewer judged them as truthful, they would receive £10 (in the immediate condition) or £15 (in the delay condition). Participants in the delayed interviewing condition received greater compensation than participants in the immediate condition as they were required to attend two test sessions. Participants were informed that if they were rated as truthful by the interviewer they would be entered into a prize draw to win up to £150 in prize money. Participants were also informed that if they did not appear truthful**,** they would instead be asked to write a statement about what happened during the study. We used the possibility of a monetary reward and time-consuming written statement as additional incentives to motivate participants to convince the interviewer of their honesty. In reality, in addition to the standard compensation (£10 for the immediate and £15 for the delayed interviewing condition), all participants (irrespective of condition or performance in the interview) were entered into the prize draw (and none were required to write a statement). Three winners of the prize draw were randomly selected and awarded £150, £75 and £50.

All participants watched the video on a laptop. After the video, participants in the delay condition where 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 after three-weeks. All participants in the delay condition returned for the second phase of the study**.** 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 informing the participant that they would be questioned about the video. All participants were permitted as much preparation time as they required. 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). Upon completion, participants were interviewed.

The interview

The same interviewer was used throughout the experiment and all interviews were audio and video recorded. The interviewer was blind to the experimental condition of the interviewees, and was blind to the content of the video. The interview protocol was identical for all participants and comprised three questions. Interviewee's were asked to describe in as much detail as possible: (1) what the surveillance device in the video looked like; (2) everything they could remember about what the surveillance device could do (i.e. what its functions where); and (3) as much information as possible about where the device is going to be planted.

After the interview, participants were given a post-interview questionnaire to complete. In this questionnaire, participants were asked to rate their motivation for performing well during the interview (on a 7-point Likert Scale, ranging from 1 extremely unmotivated to 7 extremely motivated), 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

The coding procedure was the same as in Experiment 1. A second coder (also blind to the veracity of the statements) coded a random selection of 20 statements (20%) for all the dependent measures. Inter-rater reliabilities between the two coders for the occurrence frequency of perceptual, spatial and temporal detail were measured via intra-class correlation coefficients (ICC). The ICC was high and therefore satisfactory for total spatial details [ICC] = .85, temporal details [ICC] = .87, perceptual details [ICC] = .92 and total details [spatial, temporal and perceptual information combined ICC] = .93. The three sub-categories of detail were introduced to facilitate (inter-rater) reliability coding. Since no hypothesis was formulated about this, we just report the total detail results in this article.

Results

Manipulation Check

Veracity

Truth tellers rated their statements (M = 85.20%, SD = 9.95, 95% CI [82.64, 87.84]) as significantly more truthful than liars rated their statements (M = 24.00%, SD = 11.78, 95% CI [20.77, 27.66]), $t(98)= 28.068$, $p< 0.001$, d = 5.61, 95% CI [4.67, 6.39].

Motivation

Overall, participants reported being highly motivated (M = 6.44, SD = 0.62, 95% CI [6.31, 6.57]) to perform well in the experiment. No main effect for Veracity, $F(1,96)= .101$, $p= .751$ or Interview Time $F(1,96)= 1.620$, $p= .206$ emerged, and the Veracity X Interview Time interaction was not significant either, $F(1,96) = .101$, $p= .751$.

Hypothesis testing

A 2 (Veracity) X 2 (Interview Time) analysis of variance (ANOVA) using overall reported detail as the dependent variable revealed a main effect for Veracity, $F(1,96)= 5.464$,

MSE = 4678.56, p = .021. A significant main effect for Interview Time also emerged, $F(1,96)$= 3.431, MSE = 2937.64, p = .034. Furthermore, the Interview Time X Veracity interaction was significant, F(1,96)= 4.577, MSE = 3918.76, p= 0.035, η_p^2 = .05.

Truth tellers in the Immediate condition (M = 69.48, SD = 41.88, 95% CI [53.80, 87.00]) reported more details than truth tellers in the Delay condition (M = 46.12, SD = 30.54, 95% CI [35.72, 59.00]), $t(34.099) = 2.831$, p = 0.004, d = 0.64, 95% CI [.06, 1.20]. In contrast, liars in the Immediate condition (M = 43.28, SD = 19.67, 95% CI [36.88, 51.69]) and liars in the Delay condition (M = 44.96, SD = 18.75, 95% CI [37.96, 52.14]) did not differ significantly in terms of the number of details reported, $t(48) = .162$, p= 0.872, d = 0.09, 95% CI [-.47, .64]. This interaction effect supports Hypothesis 3.

Classification

We ran two discriminate analyses to distinguish between honest and deceptive participants in the i) Immediate and ii) Delay interview conditions separately. In both cases, the objective Veracity group belonging (truth tellers or liar) was the classifying variable and overall reported detail was the predictor. We present the cross-validated 'leave-one-out' results. As Table 3 shows, a significant discriminant function emerged for distinguishing between truth tellers and liars in the immediate interviewing condition, $\chi^2(1) = 7.336$, Wilks' $\lambda = .857$, p =0.007, (canonical correlation was .38). This function correctly classified 88.0% of liars and 44.0% of truth tellers, resulting in an overall accuracy rate of 66.0%. The discriminate analysis distinguishing between liars and truth tellers in the delay condition was not significant, $\chi^2(1) = 0.026$, Wilks' $\lambda = 0.999$, p= 0.872, (canonical correlation was .02). This supports Hypothesis 4.

[Insert Table 3 about here]

Discussion

Study 2 revealed a similar pattern of findings to Study 1. Truth tellers in the immediate interviewing condition reported more details overall than truth tellers in the delay interviewing condition, whereas the number of details reported by liars did not vary as a function of delay interval (supporting Hypothesis 3). Thus, liars in Experiment 2 displayed a similar stability bias as observed in Experiment 1. This was the case despite liars utilizing real memory derived from an *actual* delay. As such, the difference between liars and truth tellers in terms of overall detail found in the immediate condition (and often reported in deception literature) collapsed in the delay condition. This resulted in superior deception detection performance (see table 4) using overall detail in the immediate (cf. delay) interviewing condition (supporting Hypothesis 4).

General Discussion

In two experiments we explored the effect on liars and truth tellers of providing statements with or without a 3-week delay interval. In Experiment 1 liars displayed a stability bias when incorporating a *simulated* (i.e. unexperienced) delay into their fabricated scripts and Experiment 2 liars displayed the same bias when incorporating *actual* (i.e. experienced) delay into their statements derived from memory. The quantity of overall details reported by liars did not vary as a function of interview time in either Experiment 1 or 2. The stability bias appears to affect liars when both generating outright fabrications (lies derived from mental simulations of experiences; Experiment 1) and when telling embedding lies (lies derived from genuinely experienced events; Experiment 2). In the case of embedded lies, this stability bias occurs despite the actual memory presumably providing liars with some index of how memory strength fades across time. However, neither the necessary application of theory-based cues (Experiment 1) nor the availability of memory derived from experience (and presumably, experienced-based cues of realistic memory strength; Experiment 2) allowed liars to accurately calibrate for the effects of forgetting across time. This is a

theoretically novel finding and suggests the presence of an interesting metacognitive error within the accounts of liars (e.g. Vrij et al., 2009).

To explore the possibility that liars display a stability bias for overall detail but not for specific detail categories, we reanalysed the data examining spatial, temporal and perceptual details individually for both Experiment 1 and Experiment 2. The pattern of results for liars were similar across both experiments as obtained for overall detail. In Experiment 1, liars reported more spatial detail in the delay condition (versus the immediate condition), with the quantity of temporal and spatial detail not varying as a function of interview time. Truth tellers reported less spatial, temporal and perceptual detail in the delay condition than in the immediate condition. In Experiment 2, liars again reported more spatial detail in the delay condition (versus the immediate condition), while the quantity of temporal and spatial detail not varying as a function of interview time. Truth tellers reported less spatial detail in the delay versus the immediate condition. Truth tellers reported less perceptual and temporal detail in the delay versus immediate condition, although these trends did not research significance (full analyses are available from the first author). Thus, the observed stability bias for liars in terms of overall quantity of reported detail appears to generalise to spatial, temporal and perceptual details categories individually.

There are (at least) two explanations for the stability bias amongst liars in respect to reported details. Liars may be (i) cognitively unable (e.g. Koriat et al., 2004) or (ii) strategically unwilling (e.g. Köhnken, 1989, 1996, 2004) to simulate the effects of forgetting across retention interval. Liars may be unable to correctly estimate the degree to which memory retrieval failures occur, and how memory changes (i.e. decays) across time (e.g. Koriat et al., 2004), due to implicit biases and false beliefs regarding memory performance (Loftus et al., 1980; Ost et al., 2016; Simons et al., 2011). Thus, liars may believe stereotypical truth tellers to have vivid memories of past events. Liars may also be

strategically unwilling to leave out too many details due to concerns that disclosing statements bereft of detail jeopardises their credibility (e.g. Köhnken, 1989, 1996, 2004). Future research should isolate the boundary conditions and underlying mechanism responsible for the stability bias amongst liars. One potential means of doing so is to examine the robustness of the stability bias effect to counter-measures (e.g. informing interviewees about the stability bias). For example, Koriat et al. (2004; Expt. 7) found that framing time intervals explicitly in terms of forgetting (i.e. asking individuals to estimate how many word-pairs *will be forgotten*) was effective at eliciting more accurate estimates of retention rates over time. As such, if counter-measure information was framed in terms of forgetting (e.g. 'consider carefully how much a truth teller would forget from time A to time B'), liars may no longer display the stability bias if such a bias is underpinned by a cognitive difficulty in accurately calibrating the appropriate level of detail to report. If true, the empirical question becomes if liars would then over, under, or accurately estimate the appropriate level of detail to disclose. However, if liars are driven by a strategic unwillingness to leave out too many details, then counter-measures instruction framed in such a manner may have minimal effect.

It is possible that liars may be able to calibrate their reports to take into account the effect of delay, but not with respect to detail measured using Reality Monitoring criteria. Although future research should explore this possibility, the current findings with respect to Reality Monitoring measured detail have clear theoretical and practical implications for verbal lie detection. The quantity of reported detail is typically a reliable cue to credibility (Amado et al., 2016; DePaulo et al., 2003; Vrij, 2008), with liars reporting fewer details than truth tellers (for theoretical explanations of this finding, see Vrij, 2008; Köhnken, 1989, 1996, 2004; Masip & Herrero, 2013; Nahari, Vrij, & Fisher, 2014). Reality Monitoring detail criterion definitions are extensively employed within the lie detection literature (e.g. Colwell et al., 2013; Nahari, Vrij & Fisher, 2014; Lancaster et al., 2014). The finding that in our

experiments after delays, detail (as operationalized using Reality Monitoring criteria) did not distinguish liars from truth tellers is relevant for the wider verbal deception literature, as it suggests that accurate verbal lie detection after a delay is difficult. However, this finding should be interpreted within the experimental contexts. The lack of differences between truth tellers and liars in the delayed interviewing condition could be attenuated by the nature of the experimental task. For example, the scenario experienced by the truth tellers in both experiment 1 and 2 where of a short duration and of no personal significance to them (outside the experimental scenario). Plausibly, different findings will emerge when truth tellers discuss rich event in the past that had genuine 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 liars who made up a story about such a trip (Vrij et al., 2016). However, the general principle that the completeness of recalls systematically decreases as the delay between witnessing an event and recall increases also applies to such richer and more important events.

The finding that liars display a metacognitive error (a stability bias) when lying after a delay may itself present a tactical opportunity and could be theoretically *exploited* by proactive interview protocols. The use of interview protocols that facilitate enhanced retrieval after delay intervals may elicit additional detail from truth tellers. Liars may be unable to take into account their effect on genuine recall. Accordingly, such manipulations may elicit verbal cues to deception after delay intervals, with liars being less detailed than truth tellers. The use of interview protocols that encourage interviewees to say more may also elicit verbal cues to deceit but in the opposite way: Due to the stability bias liars may be tempted to provide more additional detail than truth tellers, which would make liars more detailed than truth tellers. Further research should explore these two possibilities.

There is one feature of the design that warrants further discussion. We changed both the

setting of the liars' task (i.e. from insurance settings in Experiment 1 to intelligence settings in Experiment 2) as well as the *nature* of the liars' task (i.e. from a hypothetical delay interval in Experiment 1 to an actual delay interval in Experiment 2). Our motivation for varying the nature of the liars' task (from a simulated delay in Experiment 1 to an actual delay in Experiment 2) was to examine the boundary conditions of the stability bias for liars. Our motivation for varying the setting of the liars' task (from an insurance setting in Experiment 1 to an intelligence setting for Experiment 2) was to examine the generalisability of the stability bias to different deception settings. Previous research has highlighted that different contexts afford different challenges to lie detectors and opportunities to liars. Although the principle objective of our experiments was *not* to show that the stability bias is entirely unaffected by the forensic setting, future research should explore this possibility.

Conclusion

Interviews with suspects often occur with at least some delay interval between the target incident and the interview taking place. Understanding how verbal cues to deception vary as a function of retention interval is of practical importance to the deception and investigative interviewing literature. Across two experiments we investigated how the quantity of information reported by liars and truth tellers varied as a function of delay interval between the supposed event and the interview. In both experiments, liars displayed a stability bias with respect to the overall detail reported whereas truth tell tellers in both studies reported fewer details in the delay versus immediate conditions. Consequently, accurate discrimination between liars and truth tellers was only possible across both experiments in the immediate condition. Critically, liars are susceptible to committing a metacognitive error when lying after extended retention intervals. This stability bias appears to be robust and applies irrespective of whether liars incorporate retention interval into their statements via outright fabrication (i.e. simulation employing theory-based cues) or use actual memory (i.e.

embedding using available experience-based cues) from the past.

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Appendix 1 (Experiment 1 Liar materials)

'You have been asked to convince the interviewer you are telling the truth and experienced a loss of a tablet device [earlier today/ 3-weeks ago]. To help you do this, review the materials below that provide detail about the truth teller's task (who did experience a loss of a tablet device [earlier today/ three-weeks ago]). As you have been instructed, you should use these details as your own and pretend the events described below occurred to you. Take as much time as you require to prepare yourself.'

Description of the Truth Tellers Task

The following events occurred to the truth telling participants [earlier today/ three weeks ago]. After signing informed consent, the experimenter explains to the Truth teller (the participant) that the study will be conducted in a local bar (*The Fleet*). The truth teller follows the experimenter to Technicians Office (on the second floor of the Department) where they sign for and collect the iPad and a charging cable from a member of the technical support staff, with the testing application pre-loaded onto it.

Participants were then escorted by the experimenter to the local bar where they were intercepted by a female PhD student. The PhD student explained that she required assistance from the experimenter regarding a manuscript she is preparing for their supervisor. The experimenter explained that he was running a study but suggested the confederate to join him and the participant to the bar. Once inside, the participant, researcher and confederate sat down at a round table from which it was not possible to see the bar. The participant was handed the tablet device and instructed to open an application (for the study). The tablet device was not charged and so the participant found that they were not able to open the application due to low battery levels. The researcher then suggested taking it to the bar and

asking the bar staff if it could be charged. The participant accompanied the experimenter to the bar and the bar staff accepted the device, taking it to be 'charged'.

The experimenter offers the participant a (non-alcoholic) drink of their choice (he buys one for the confederate and himself regardless) and pays. Taking the drinks back to the table, the researcher then read the confederate's manuscript, whist the participant and confederate played three rounds of a popular game (ConnectFour). After 15 minutes, the participant and the experimenter returned to collect the device, to be told it had already been taken by someone the staff assumed was a member of the research team. The experimenter asks the confederate and the participant if they had seen anything (nobody could have given the position of the table in relation to the bar). The experimenter then said that they should return to the department to be interviewed about what happened.

Delay condition only

The experimenter tells the participant they will be interviewed about the loss of the tablet when interviewing facilities become available. Because all interviewers and rooms are currently being used, the participant arranges with the experimenter to return in three-weeks to be interviewed at the Department. Hence, you should pretend the events described above occurred three-weeks ago.

Immediate condition only

The experimenter tells the participant they will be interviewed about the loss of the tablet when interviewing facilities become available. Because interviewers and interviewing rooms are currently available, the truth teller arranges with the experimenter to be interviewed at the Department immediately. Hence, you should pretend the events described above occurred earlier today.

'To further aid you describe the event from the truth teller's perspective (and provide suitable detail), please study photos of the location of the events described above and the map showing the route taken by participants from the Psychology Department (your current location) there. You should use this information to provide suitable detail but you may provide additional detail (of your choice) if you wish.'

'Based upon all the information provided, please prepare yourself for the interview. You have been asked to convince the interviewer you are telling the truth and experienced a loss of a tablet device [earlier today/ 3-weeks ago]. Please ask the experimenter if you have any questions and take as much time as you require to prepare yourself.'

Table 1

Self-report memory scores as a function of Interview Time as a function of interview condition in Study 1

	Immediate interviewing condition			Delayed interviewing condition							
	M	*SD*	95% CI	*M*	*SD*	95% CI	*t*	*df*	*p*	Cohen's *d*	95% CI
Truth teller's memory strength											
Memory strength	5.95	1.10	5.44, 6.39	3.95	1.28	3.43, 4.53	5.310	38	$p<0.001$	1.68	.93, 2.36
Memory detail	5.80	1.01	5.31, 6.21	3.75	1.25	3.25, 4.27	5.712	38	$p<0.001$	1.80	1.04, 2.50
Memory clarity	5.75	1.21	5.21, 6.26	3.70	1.22	3.17, 4.24	5.343	38	$p<0.001$	1.69	.94, 2.37
***Liars'** script strength*											
Memory strength	5.80	1.15	5.26, 6.26	4.85	0.88	4.42, 5.20	2.937	38	$p=0.006$	0.93	.26, 1.56
Memory detail	5.95	0.94	5.55, 6.32	4.45	1.15	3.89, 4.92	4.517	38	$p<0.001$	1.43	.71, 2.09
Memory clarity	5.60	1.14	5.08, 6.07	4.60	1.05	4.12, 5.05	2.887	38	$p=0.006$	0.91	.24, 1.54

Table 2

Classification Rates for Overall Detail as a Function of Interview Time in the Hypothetical Delay Scenario (Study 1)

	Immediate			**Three-week Delay**		
	Truth Teller (%)	Liar (%)	Total (%)	Truth Teller (%)	Liar (%)	Total (%)
Overall Detail						
Hit rate	**65.0**	**80.0**	**72.5**	75.0	45.0	60.0

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

Table 3

Classification Rates for Overall Detail as a function of Interview Time in the Real Delay Scenario (Study 2)

	Immediate			**Three-week Delay**		
	Truth Teller (%)	Liar (%)	Total (%)	Truth Teller (%)	Liar (%)	Total (%)
Overall Detail						
Hit rate	**44.0**	**88.0**	**66.0**	8.0	56.0	44.0

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