

Visuospatial Counter-Interrogation Strategies by Liars Familiar with the Alibi Setting

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Abstract

This study examines counter-interrogation strategies employed by liars giving false alibis. Participants ($N = 144$) visited a restaurant to buy a sandwich (truth-tellers) or to use it as a false alibi (liars). Half of the liars were informed they might be asked for a drawing of the alibi setting if interviewed (informed liars). Participants spent either 10 minutes (high familiarity condition) or 30 seconds (low familiarity condition) in the restaurant. All participants were asked to provide two visuospatial statements, which were assessed for salient details, non-salient details, between-statement consistency, and statement-alibi setting consistency. Informed liars provided significantly more salient and non-salient details than uninformed liars and truth-tellers, particularly in the high familiarity condition. No differences emerged for statement consistency types. The results suggest that liars are more concerned than truth tellers about making a positive impression on the interviewer, and they fail to accurately reflect on truth-tellers' visuospatial statements.

Visuospatial Counter-Interrogation Strategies by Liars Familiar with the Alibi Setting

Consider a man who travels by car from the place where he lives to a distant city that he has never visited before. The man books a room in a hotel for one night. On that evening, the man targets a woman walking on the streets, abducts her in his car, and strangles her in a nearby scrapyard. The murderer then goes to a nearby pub for two hours and returns back to the hotel afterwards. On the next day, he goes to his workplace, acting as if nothing has happened.

Consider another incident in which a woman murders someone in her neighbourhood and heads immediately afterwards to a festival that is hosted for the first time in the city. The woman stays there for half an hour before going home.

Now imagine these two murderers were suspected by the police and questioned about the relevant crime. The suspects say they were at the pub/festival when the crime occurred, giving a false alibi. Investigators may want to establish if the suspects were in the claimed alibi location at the time the crime occurred. This can be determined if detailed questions about the alibi setting are asked. For the first case, investigators may come to know that the murderer booked a room for one night in a hotel situated near the crime location, so if he was in the pub, it would probably have been on the same night. Detailed questions about the suspect's stay at the pub may clarify whether he was there and the time he might have been there. For the second case, the suspect may also be asked detailed questions about the festival, which has never happened previously in the city. Hence, asking the suspect about the setting, decoration, bands' appearances and order, among others, would assist officers in understanding whether the suspect was there or not.

Now imagine that the same murderers, before committing the crime, explored interview techniques that investigators employ. Knowing the type of questions that officers ask during

interviews will help the murderers prepare for the interview and provide convincing responses if they are suspected and questioned. These counter-interrogation strategies are often employed by liars so that they appear credible and avoid detection in investigative interviews (Honts, Raskin, & Kircher, 1994; Vrij, Granhag, & Porter, 2010). Information on investigative interview techniques can be easily found in, amongst others, scholarly work (e.g., Carson, Milne, Pakes, Shalev, & Shawyer, 2007), online websites (e.g., www.legislation.gov.uk/ukpga/1984/60/contents; The National Archives, 2017), and terrorist organisations' manuals (e.g., *The Green Book*; Conflict Archive on the INternet, 2016). In the current study, we aim to examine the effectiveness of counter-interrogation strategies when suspects who are highly or poorly familiar with their alibi setting are asked to provide visuospatial statements (e.g., drawings) of the setting.

Counter-Interrogation Strategies in Lie Detection Contexts

Liars want to make an honest impression on investigative interviewers, so they actively plan and prepare for the interview by anticipating the questions that will be asked and rehearsing responses to them (Clemens, Granhag, & Strömwall, 2013; Hartwig, Granhag, Strömwall, & Doering, 2010; Vrij, Mann, Leal, & Granhag, 2010). Preparation enables liars to avoid the need to improvise spontaneous lies (Vrij, Granhag, Mann, & Leal, 2011) and to stick to their cover story during the interview and hence provide a consistent statement (Granhag & Strömwall, 2002; Vrij et al., 2009).

Research on counter-interrogation strategies has shown that liars can counter credibility assessment tools if they are acquainted with them. Criteria-Based Content Analysis (CBCA) and Reality Monitoring (RM) are verbal lie detection tools that assume that statements about experienced events are more detailed and coherent than statements about unexperienced events

(Johnson & Raye, 1981; Vrij, 2005, 2008). A study examining the coaching of 180 children and undergraduate students in CBCA and RM revealed that coached liars, but not uncoached liars, obtained similar scores as truth-tellers (Vrij, Akehurst, Soukara, & Bull, 2004). These results confirmed earlier findings by Vrij, Kneller, and Mann (2000) which showed that CBCA coaching helped liars to counter this lie detection tool. Other credibility assessment tools such as EEG scans and polygraph examinations are also susceptible to counter-interrogation strategies (Granhag, Vrij, & Verschuere, 2015; Honts et al., 1994).

Liars attempt to control their nonverbal behaviour during interviews by avoiding behaviour commonly associated with deception such as gaze aversion and nervousness (DePaulo et al., 2003; Granhag, Andersson, Strömwall, & Hartwig, 2004; Strömwall & Willén, 2011). However, they do not achieve full control of their nonverbal behaviour, even when explicitly informed about the negative relationship between nonverbal behaviour and deception (Vrij, Semin, & Bull, 1996). Similarly, studies on the verifiability approach have shown that liars fail to provide as many checkable details as truth-tellers following instructions that the interviewer will be verifying information they provide in their statements (Harvey, Vrij, Leal, Lafferty, & Nahari, 2017; Nahari, Vrij, & Fisher, 2014). Overall, these findings suggest that liars attempt to employ several strategies to appear credible, but they do not always succeed in imitating truth-tellers' behaviour and statements. Therefore, it is important to examine possible counter-interrogation strategies and the effect of these strategies on liars' statements.

Visuospatial Statements in Interviews with Suspects

Visuospatial statements are increasingly being used as an interview tool in investigative settings and as evidence in courts (Marlow & Hilbourne, 2011). Suspects, particularly liars, who are asked for a visuospatial statement find this report mode more unanticipated and difficult than

if asked for a verbal statement (Vrij et al., 2009). When reporting verbally, liars can omit information and provide vague statements (Hartwig, et al., 2011), but when reporting visuospatially, liars have to be detailed and consistent in providing spatial information (i.e., locate objects in their correct location).

A study that examined self-generated drawings showed that liars who drew an imagined workplace were significantly less detailed than truth-tellers who drew their actual workplace (Vrij, Mann, Leal, & Fisher, 2012). However, another study that investigated self-generated drawings by police officers revealed that officers in the liar condition did not differ significantly on the number of details from officers in the truth-teller condition (Vrij, Leal, et al., 2010). The researchers explained that liars thought of a familiar setting which may have resulted in the similar number of details provided by liars and truth-tellers. It may therefore be important to examine the type of details and not only the number of details (Mac Giolla, Granhag, & Vernham, 2017).

The saliency of details in suspects' statements has been examined in previous studies (Masip, Blandón-Gitlin, Martínez, Herrero, & Ibabe, 2016; Roos af Hjelmsäter, Öhman, Granhag, & Vrij, 2014). Salient details are defined as central details about an event which are most likely to attract attention, whereas non-salient details are peripheral details about the event that may not be noticeable (Heath & Erickson, 1998). When salient (central) and non-salient (peripheral) aspects of an event were distinguished in visuospatial statements, deceptive triads who fabricated the event together and were then interviewed about it individually, were not consistent with each other about the salient and non-salient details (Roos af Hjelmsäter et al., 2014). In contrast, truth-telling triads who experienced the event together were consistent with each other about the salient details. Hence, truth-tellers focused on, and had a better memory for,

salient aspects, so they were able to incorporate those aspects consistently in their statements. This finding is in line with the eyewitness and memory literatures which have established that people tend to correctly remember and consistently report salient details of an event to a greater extent than non-salient details (Herlihy, Scragg, & Turner, 2002; Wright & Stroud, 1998).

In sum, visuospatial statements seem to be a promising tool in distinguishing truth-tellers from liars (Mac Giolla et al., 2017). Nonetheless, it is important that investigators take into account the reported salient and non-salient aspects of the event—as well as the familiarity of the suspect with the event as we explain below.

Suspects' Familiarity with the Reported Event

To our knowledge, there are only three studies that have examined suspect's familiarity with the reported event in the context of deception. Children aged 9-12 who reported about an event they were familiar with scored higher on CBCA, indicating more truthfulness, than children of the same age group who were unfamiliar with the reported event (Blandón-Gitlin, Pezdek, Rogers, & Brodie, 2005). These differences remained whether the children were lying or telling the truth. Similar results were obtained in a study examining deception in mock job interviews with undergraduate students (Warmelink, Vrij, Mann, Leal, & Poletiek, 2013). Liars who were familiar with the job could not be distinguished from truth-tellers who were familiar with it, and liars who were unfamiliar with the job were rated as lowest in truthfulness. Finally, a study to discern true and false intentions among undergraduate students who fabricated or told the truth about an activity they intended to execute in a familiar or unfamiliar setting found that truth-tellers had a more vivid mental image of the activity and setting than liars (Knieps, Granhag, & Vrij, 2014). Although familiarity did not moderate these results, those who were familiar with the physical setting could describe it in more details than unfamiliar participants.

The results of these studies are not easy to compare, because the studies differed in their purpose, sample, and design. Nonetheless, it can be inferred that familiarity plays a critical role in verbal statements. As liars' familiarity with the reported event increased, the statements of liars and truth-tellers became more similar. This inference is in line with findings from the spatial cognition literature that the longer individuals are exposed to a setting, the more familiar they become with it and the better their performance and accuracy on relevant spatial tasks (Prestopnik & Roskos-Ewoldsen, 2000). In a parallel manner, when liars have no experience of the reported event, they do not have a memory representation of it, so they find it difficult to include relevant spatial, sensory, and other details in their statements (Gnisci, Caso, & Vrij, 2010; Masip, Sporer, Garrido, & Herrero, 2005). This results in liars providing less detailed and consistent statements than truth-tellers who, by definition, have experienced the event (Leins, Fisher, & Vrij, 2012; Roos af Hjelmsäter et al., 2014; Vrij et al., 2009). However, if liars report about an experienced event, they would become as detailed and as forthcoming as truth-tellers (Vrij, Leal, et al., 2010; Warmelink et al., 2013).

The Self-Regulation Theory

In this section, the theory upon which the hypotheses were based is presented. The self-regulation theory posits that individuals attempt to control their behaviour through natural, automatic tendencies to achieve long-term goals (Bauer & Baumeister, 2011; Baumeister & Alquist, 2009). In an investigative interview, both liars and truth-tellers want to present themselves positively to the interviewer (DePaulo et al., 2003; Granhag & Hartwig, 2008). Hence, liars and truth-tellers need to change their behaviour to make an honest impression. Nonetheless, they differ in their information management strategies, because truth-tellers provide information honestly, whereas liars rehearse their lies, avoid providing incriminating

information, and control the amount and content of the information they provide (Granhag, Vrij, et al., 2015; Hartwig et al., 2010). Therefore, liars exert more effort than truth-tellers in controlling their behaviour, but their strategies do not always succeed. If, for example, the interviewer asks them unanticipated questions (e.g., visuospatial statements), liars can no longer use the responses they prepared which eventually depletes their cognitive resources, and they become less detailed and consistent than truth-tellers (Vrij et al., 2009). When suspects are asked to provide verifiable details, liars will not provide this information because that would incriminate them (Nahari et al., 2014). Also, if liars report about an unfamiliar event, they cannot be detailed and forthcoming, because they do not have a memory representation of the event (Masip et al., 2016; Warmelink et al., 2013).

Liars' strategies may be more successful if they report about a familiar, non-criminal event as that allows them to refrain from revealing incriminating information and, at the same time, to be forthcoming by including as many details as possible about the familiar event (Vrij, Leal, et al., 2010). Hence, the more familiar liars are with the reported event, the more detailed their statements become (Blandón-Gitlin et al., 2005; Warmelink et al., 2013). Liars may assume that this forthcomingness, which is generally associated with honesty (Deeb, Vrij, Hope, Mann, Granhag, & Strömwall, 2017; DePaulo et al., 2003; Greuel, 1992), would make them appear truthful (Granhag, Vrij, et al., 2015). Nonetheless, this does not mean that their statements would be similar to those of truth-tellers.

Research has shown that liars do not have an adequate understanding of truth-tellers' metacognitive processes (Harvey, 2013; Vrij et al., 2009). Their primary focus is to provide detailed and consistent statements rather than statements similar to those of truth-tellers (Deeb, Vrij, Hope, Mann, Granhag, & Lancaster, 2017; Harvey, Vrij, Leal, Hope, & Mann, 2017;

Sakrisvold, Granhag, & Mac Giolla, 2017; Strömwall & Willén, 2011). While they are able to provide statements that resemble those of truth-tellers if they are equally familiar with the reported event (Blandón-Gitlin et al., 2005; Warmelink et al., 2013), their concern about being detailed and consistent may make them more detailed and consistent than truth-tellers when they employ counter-interrogation strategies (Deeb, Vrij, Hope, Mann, Granhag, & Lancaster, 2017; Granhag & Strömwall, 2002; Harvey, Vrij, Leal, Hope, et al., 2017). In other words, liars who are familiar with the reported event or interview technique may not necessarily provide statements similar to those of truth-tellers.

The Current Study

The main purpose of our study was to examine the effect of counter-interrogation strategies on liars' visuospatial statements about an alibi setting. Half of the liars possessed information about the interview technique before committing a mock crime (informed liars). None of the truth-tellers were provided with this information (uninformed truth-tellers), because in real life, when a crime is committed, truth-tellers (i.e., innocent suspects) are often not aware of the crime as they have nothing to do with it. Hence, they cannot possibly anticipate they will be mistakenly accused of the crime and interviewed about it, and thus they do not rehearse responses for interview questions (Granhag & Strömwall, 1999; Nahari & Vrij, 2014; Vrij, Mann, et al., 2010). Accordingly, it was not logical for truth-tellers to receive instructions about a forthcoming interview. Previous deception studies have used similar designs that excluded truth-tellers where the scenario would not apply to innocent suspects (Honts et al., 1994; Nahari & Vrij, 2015; Tekin, Granhag, Strömwall, & Vrij, 2016).

One way liars can cover up for their crime is by providing a false alibi. As it is common for liars to provide information about events they have experienced (Culhane, Hosch, & Kehn,

2008; Leins, Fisher, & Ross, 2013), they would want to familiarise themselves with the alibi setting to be able to demonstrate they were at the setting when the crime occurred. Previous familiarity studies have only examined the statements of liars who were either well familiar or not familiar at all with the reported event (Blandón-Gitlin et al., 2005; Knieps et al., 2014). Familiarity, however, involves different levels as suspects may be somehow familiar with the event or extremely familiar with it. To reconcile this gap in the literature, the second purpose of our study was to examine if informed liars differ from uninformed liars and uninformed truth-tellers when they are highly or poorly familiar with the alibi setting. Moreover, as questions about the alibi setting are particularly useful if the suspect has not frequently visited the alibi setting, the current study examines cases in which suspects provide an alibi for a location they visited only on the date the crime occurred.

All participants were able to provide a true or false alibi and to talk about it. However, liars also had to withhold information about the crime and to lie about the time they were at the alibi setting (withholding incriminating information is also considered lying; for an overview on types of lies, see Vrij, 2008). Hence, even though liars visited the alibi setting and could respond honestly to questions about it, the counter-interrogation strategies they would employ from preparing for the interview to withholding information about their criminal activities to maintaining consistency would not be used by truth-tellers (Granhag, Mac Giolla, Strömwall, & Rangmar, 2013; Vrij, Mann, et al., 2010). This is in line with the self-regulation theory as liars who employ counter-interrogation strategies tend to be more deliberate than truth-tellers when preparing and reporting about their alibi (Granhag, Vrij, et al., 2015; Hartwig et al., 2010). Given that liars are likely to withhold incriminating information and to be forthcoming when they report about a familiar alibi, the main focus of the current study is on differences between liars'

and truth-tellers' statements in response to questions about their alibi, and specifically about the setting.

Taken together, we examined the effects of familiarity and veracity information status on the number of reported salient and non-salient details of the alibi setting, consistency between the visuospatial statement and the alibi setting (hereafter referred to as statement-alibi setting consistency), and consistency between two visuospatial statements (hereafter referred to as between-statement consistency). Participants were interviewed twice using different visuospatial tasks to measure between-statement consistency. Previous research has shown that varying question format across interviews has helped truth-tellers recall more information in subsequent interviews (Fisher, Brewer, & Mitchell, 2009; Granhag, Strömwall, & Jonsson, 2003), but has hindered liars from repeating information due to the difficult nature of the task (Deeb, Vrij, Hope, Mann, Granhag, & Lancaster, 2017; Leins et al., 2012). Hence, we were interested in exploring whether varying the visuospatial tasks across interviews would have an impact on statements by liars who employ counter-interrogation strategies. To operationalise the terms, between-statement consistency was defined as the number of repeated items in the two visuospatial statements, and statement-alibi setting consistency was defined as the number of reported details in each visuospatial statement that accurately matched items found in the alibi setting.

In general, we expected all participants in the high familiarity condition to score higher on the number of salient and non-salient details, statement-alibi setting consistency, and between-statement consistency than participants in the low familiarity condition (Hypothesis 1). In line with the self-regulation theory, we predicted that liars and truth-tellers would want to convince the interviewer of their credibility but only liars would employ information

management. In other words, liars would withhold information about the crime and include as many details as possible about the alibi. Nonetheless, uninformed liars and uninformed truth-tellers who spend the same duration at the alibi setting would have the same memory representation of it and would therefore not differ in their statements. On the other hand, when liars obtain information about the interview technique before committing the mock crime (informed liars), they are likely to prepare for the interview technique and look more closely at the alibi setting prior to the interview. This enables them to be more forthcoming about the alibi than truth-tellers and to provide detailed and consistent statements. Therefore, informed liars were expected to score higher than uninformed liars and uninformed truth-tellers on salient and non-salient details, statement-alibi setting consistency, and between-statement consistency (Hypothesis 2). We anticipated that the differences between informed liars and uninformed liars and truth-tellers would be more pronounced in the high familiarity condition than in the low familiarity condition (Hypothesis 3), because informed liars have a stronger memory representation of the alibi setting when they stay longer there.

Method

Participants and Design

A total of 144 participants (61.5% females; $M_{age} = 27.65$ years, $SD_{age} = 10.38$) were recruited through the participant pool database at the University of Gothenburg to participate in a study on ‘networking strategies’. Volunteers received a free lunch as part of their participation, and their names were entered in a draw to win two movie tickets. We obtained ethics approval for the study through the University Ethics Committee.

A 3×2 randomised between-participants design was used with veracity information status (informed liars, uninformed liars, uninformed truth-tellers) and familiarity (high

familiarity, low familiarity) as factors and the salient details, non-salient details, statement-alibi setting consistency, and between-statement consistency as dependent variables. Participants were equally distributed to the conditions, with 24 participants in each cell.

For the analysis, an average score was calculated for the salient details and non-salient details provided by each participant in the two interviews. A between-statement consistency proportion score (Repetitions provided in the second interview/total number of details provided in the first interview) was also calculated, because the number of repeated details provided in the second interview varies with the number of details provided in the first interview. Similarly, a statement-alibi setting consistency proportion score was calculated for each visuospatial statement (Reported items that are consistent with the alibi setting /total number of details in the statement), and then the scores of statements provided by each participant were averaged.

Procedure

Liars. Liars were given briefing instructions to imagine there was a visitor at the department who might have violent radical views. They were asked to steal her USB memory stick, which was suspected to include extremist material, from her office, and to deliver it to a mail box in the building so that a member of university staff could inspect the contents. To have a cover story in case they were suspected of stealing the USB stick, they were given a free sandwich coupon from a local restaurant so they could use the restaurant as an alibi. All participants were asked prior to their appointment if they had ever visited the restaurant specified in the instructions. Only those who had never visited it were eligible to participate in the study.

Liars randomly allocated to the informed liars condition received these additional instructions:

If the radical visitor or anyone else suspects you of stealing the USB memory stick, they will want you to prove you were at the restaurant, so they might ask you to draw a sketch of the restaurant to confirm that you were there. Therefore, try as much as possible to attend to the layout of the restaurant and remember as many things as you can from the setting. You need to look for the smallest details in the restaurant to be able to complete the drawing.

These instructions were detailed so that liars were able to adequately process and understand the requirement of this condition. In real life cases, criminals who anticipate the interview technique are also likely to think of minute details relevant to the interview technique to be able to counter it (Honts et al., 1994).

Participants randomly allocated to the low familiarity condition spent 30 seconds in the restaurant picking up a sandwich previously ordered by phone by the experimenter. Participants in the high familiarity condition spent 10 minutes in the restaurant, so they ordered their sandwich themselves when they visited the restaurant. We decided to allocate 30 s for the low familiarity condition, because previous studies have shown that this duration is sufficient for individuals to encode different objects within a location (e.g., Brewer & Treyens, 1981). Also, previous lie detection studies have found that a few minutes were enough for truth-tellers to familiarise themselves with the cover story setting (e.g., Leins et al., 2012; Roos af Hjelmsäter et al., 2014), so 10 minutes were suggested as an appropriate duration for the high familiarity condition.

It was pre-arranged with the restaurant staff that participants in the low familiarity condition would be given a sandwich as soon as they reached the restaurant, while participants in the high familiarity condition would be given a sandwich 10 minutes from the time they entered

the restaurant. The staff members confirmed that all participants left the restaurant after being provided with the sandwich.

Truth-tellers. All truth-tellers read instructions to go to the restaurant, buy a sandwich using a free lunch coupon, and return immediately to the department. As with liars, truth-tellers in the high familiarity condition waited for 10 minutes in the restaurant to get their sandwich and those in the low familiarity condition were handed the sandwich 30 seconds after entering the restaurant.

The interviews. After participants returned to the department, they were given the opportunity to eat their sandwich. Then, they were informed that a visitor claimed she had lost her USB stick which contained personal and confidential information. Hence, she was interviewing everybody who was at the department on that day. Liars were also notified that the USB stick contained dangerous information, so they should not mention knowing anything about the USB stick or about stealing it. Liars were asked to use the restaurant as an alibi, and informed liars were reminded that they might be asked to draw the restaurant. Lastly, all participants were instructed to convince the interviewer that they were being truthful. To further motivate participants, they were informed that their names will be entered in a draw to win two movie tickets if they were convincing (in fact, all participants were entered in the draw). Participants were given as much time as they needed to prepare for the interview.

Participants were interviewed by one of four female interviewers who pretended to be the visitor who lost her USB stick. Interviewers were blind to the participants' veracity conditions and to the study hypotheses. Participants were first asked if they have stolen the USB stick. Then, the interviewer mentioned that the experimenter has informed her the participant was at the restaurant when the USB stick was stolen. To prove this was true, the participant was asked

to try to recall and draw as many details as possible from the restaurant, including decorations, tables, chairs, etc., and to imagine viewing the restaurant from the ceiling to have a full view of the restaurant. Participants were asked to draw the restaurant from a ceiling view, because a pilot study showed that when participants were not guided about the drawing, they tended to draw the restaurant from an entrance view and did not include all the zones within the restaurant.

Participants were provided with a blank A3 sheet and were given as much time as needed to complete the drawing.

Individuals tend to have different drawing skills, spatial orientation, visual attention, and memory capacity (Huang, Mo, & Li, 2012; Skogsberg et al., 2015; Vogel & Machizawa, 2004), so it was conceived that participants would differ on the number of details they provide as a result of both individual differences and experimental manipulation. Hence, participants were asked to draw the interview room to control for individual differences. The order of the requests to draw the interview room and the restaurant was counterbalanced.

After completing these visuospatial tasks, the interviewer left the room and the participant engaged in a filler task. The interviewer reentered the room after 10 minutes to start the second interview. She informed the participant she had been able to find an A3 layout sketch of the restaurant on which the restaurant's entrance door, food counter, and sofa were drawn and 37 small black-and-white photographs of items, all found in the restaurant. Participants were asked to place the correct items in their exact location, and they were given as much time as needed to complete the task. This recognition task is somewhat similar to maps used in actual investigative interviews on which suspects need to mark locations, people, and objects related to the crime (S. Kleinman, personal communication, June 27, 2016).

As in the first interview, and to control for individual differences in spatial orientation skills, visual attention, and memory capacity, participants were provided with 23 white-and-black photos from the interview room and were asked to place them on a blank A3 sheet. The questions regarding the interview room and the restaurant were also counterbalanced.

After completing these tasks, participants responded to a computerised post-interview questionnaire. They were asked to indicate their age and gender and to rate on a 7-point scale their motivation to complete the tasks involved in the experiment (1 = *not motivated at all* and 7 = *very motivated*), their anticipation of the visuospatial tasks (1 = *not anticipated at all* and 7 = *very anticipated*), their surprise when asked to complete the visuospatial tasks (1 = *not surprised at all* and 7 = *very surprised*) and the extent to which they looked closely at the restaurant setting while they were there (1 = *did not look around at all* and 7 = *looked around very much*).

Coding

Two coders, blind to the participants' condition and study hypotheses, coded the visuospatial statements of the restaurant and the interview room for the first and second interviews. The coders first coded the statements of five participants and then discussed discrepancies in the ratings. Afterwards, they coded the statements of three more participants and resolved the discrepancies. For the purpose of establishing inter-rater reliability, one coder coded the statements of 35 participants, and the other coder coded all the statements.

To determine the salient details in each of the restaurant and the interview room statements, a pilot study with 20 participants was conducted. Participants visited the restaurant/interview room and were asked to point out the salient items (i.e. items that caught their attention the most). Items chosen by more than 60% of the participants were considered salient. The salient items identified in the restaurant included foreign pastries, colourful pillows,

colourful chairs, and the employee. The salient items identified in the interview room were a sandbox, a bookshelf with toys, and the interviewer. All other items in the restaurant/interview room were considered as non-salient.

The coders counted the number of salient and non-salient details in each visuospatial statement. There were many pieces of the same salient item in the restaurant; that is, there were numerous pieces of foreign pastries, colourful pillows, and colourful chairs of the same shape. Hence, if the same (salient or non-salient) item was drawn more than once, it received a score in accordance with the number of times it appeared. For example, if the same-shaped chair was drawn four times in the same statement, a score of four was given. Also, items that were rich in details were given additional scores. For example, if a feature (e.g., colour) of a chair was provided, the chair received a score of two (one score for including the chair and one score for including the colour feature of the chair). If two features of the chair were included (e.g., colour and drawings on the chair), the same chair received a score of three.

We calculated the Intra-Class Correlation Coefficient (*ICC*), which measured the agreement between the two coders, for the restaurant and interview room statements in the two interviews. In other words, the number of salient items in the restaurant statement provided in the first interview were added to the number of salient items in the second interview. The same was done for non-salient details and for the interview room statements. For salient details, the scores ranged between 3 and 84 for the restaurant statements and between 5 and 15 for the interview room statements. The *ICC* score was .98, 95% CI [0.96, 0.99], for the restaurant statements and .92, 95% CI [0.83, 0.96], for the interview room statements. As for non-salient details, the scores ranged between 10 and 116.5 for the restaurant statements and between 15 and 33 for the

interview room statements. The *ICC* score was .97, 95% CI [0.93, 0.98], for the restaurant statements and .89, 95% CI [0.61, 0.94], for the interview room statements.

To measure between-statement consistency (i.e. repetitions) between the self-generated drawing in the first interview and the layout sketch in the second interview, the coders counted the number of repeated items (as well as repeated features of those items) in the restaurant and interview room statements. Between-Statement consistency scores ranged between 5 and 110.5 for the restaurant statements and between 12.5 and 47 for the interview room statements. The *ICCs* were .94 for both the restaurant (95% CI [0.87, 0.97]) and the interview room (95% CI [0.89, 0.97]) statements.

After rating all the statements for the number of salient details, non-salient details, and between-statement consistency, the coders visited the restaurant/interview room to code statement-alibi setting consistency (if they were acquainted with the restaurant/interview room before coding the other dependent variables, coders may have been biased in their coding). The same protocol used for coding the visuospatial statements' number of salient details, non-salient details, and between-statement consistency was used to resolve discrepancies when coding statement-alibi setting consistency. The coders gave a consistency score for each correctly drawn/chosen item that was drawn/placed in its correct location (for both the restaurant and interview room statements). Moreover, if the participant correctly included a feature of that item, the item received an additional consistency score. That is, a correctly drawn chair would receive a score of one, but if the participant correctly added a feature of that chair (e.g., colour), two statement-alibi setting consistency scores were given for that chair. For each participant, the restaurant/interview room statement-alibi setting consistency score for the first interview was combined with the score for the second interview. Scores ranged between 16 and 203.5 for the

restaurant statements and between 36 and 69.5 for the interview room statements. The *ICCs* (for the first and second interviews combined) were .98, 95% CI [0.96, 0.99], for the restaurant statements and .93, 95% CI [0.86, 0.97], for the interview room statements.

Results

Post-Interview Questionnaire

Four separate ANOVAs were conducted with familiarity and veracity information status as the independent variables and each of motivation, surprise, anticipation, or looking closely at the restaurant setting (measured on 7-point scales) as the dependent variable.¹ The analyses revealed a significant familiarity effect for motivation, $F(1, 62) = 6.56, p = .013, \eta_p^2 = .10$, with higher motivation among participants in the high familiarity condition ($M = 6.08, SD = 1.00$) than participants in the low familiarity condition ($M = 5.34, SD = 1.38$). However, the means showed that participants in both conditions were highly motivated as they scored at the upper end of the motivation scale.

A significant main effect of veracity information status was found for anticipation, $F(2, 62) = 26.53, p < .001, \eta_p^2 = .46$, with informed liars ($M = 4.23, SD = 2.20$) anticipating the visuospatial task significantly more than uninformed liars ($M = 1.33, SD = 1.11$) or uninformed truth-tellers ($M = 1.40, SD = 0.87$). In line with this finding, veracity information status showed a significant main effect for surprise, $F(2, 62) = 9.10, p < .001, \eta_p^2 = .23$, as informed liars ($M = 3.00, SD = 1.80$) reported being significantly less surprised by the visuospatial tasks than uninformed liars ($M = 5.24, SD = 1.45$) and uninformed truth-tellers ($M = 4.60, SD = 2.10$). Lastly, informed liars ($M = 4.95, SD = 1.21$) reported that they looked closely at the restaurant setting significantly more than uninformed liars ($M = 2.86, SD = 1.39$) and uninformed truth-tellers ($M = 3.20, SD = 1.50$), $F(2, 62) = 15.66, p < .001, \eta_p^2 = .34$. The uninformed liars and

uninformed truth-tellers did not differ significantly from each other on any of the variables.

Hence, our manipulations were successful.

Hypotheses Testing

We examined the correlations between salient details, non-salient details, statement-alibi setting consistency proportion score, and between-statement consistency proportion score to determine if the dependent variables were correlated and a single MANCOVA may be conducted on all dependent variables combined. Salient and non-salient details correlated significantly with each other, $r = .565, p < .001$. Also, the between-statement consistency proportion score was significantly correlated with the statement-alibi setting consistency proportion score, $r = .338, p < .001$. Importantly, non-salient details were significantly correlated with the between-statement consistency proportion score, $r = .230, p = .006$, and the statement-alibi setting consistency proportion score, $r = .231, p = .005$. These correlations indicated that details' saliency and statement consistency were interdependent, and therefore a single MANCOVA was conducted with the four dependent variables combined.

The analysis included familiarity and veracity information status as the independent variables, the restaurant's salient details, non-salient details, between-statement consistency proportion score, and statement-alibi setting consistency proportion score as the dependent variables, and the interview room's salient details, non-salient details, between-statement consistency proportion score, and statement-alibi setting consistency proportion score as the covariates. The results revealed significant multivariate main effects of familiarity, Wilk's Lambda $\Lambda = 0.76, F(4, 131) = 10.21, p < .001, \eta_p^2 = .24$, and veracity information status, Wilk's Lambda $\Lambda = 0.67, F(8, 262) = 7.32, p = .001, \eta_p^2 = .18$, and a significant multivariate veracity

information status \times familiarity interaction effect, Roy's Largest Root = 0.10, $F(4, 132) = 3.38$, $p = .012$, $\eta_p^2 = .09$.

Univariate analyses revealed that participants in the high familiarity condition scored higher than participants in the low familiarity condition on salient details, $F(1, 134) = 17.31$, $p < .001$, $\eta_p^2 = .11$, non-salient details, $F(1, 134) = 33.61$, $p < .001$, $\eta_p^2 = .20$, and statement-alibi setting consistency proportion score, $F(1, 134) = 4.73$, $p = .031$, $\eta_p^2 = .034$. Hence, Hypothesis 1 that participants in the high familiarity condition would score higher on the dependent variables than participants in the low familiarity condition received partial support.

As for veracity information status, informed liars scored higher than uninformed liars and truth-tellers on salient details, $F(2, 134) = 7.50$, $p = .001$, $\eta_p^2 = .10$, and non-salient details, $F(2, 134) = 29.52$, $p < .001$, $\eta_p^2 = .31$. Hence, Hypothesis 2 that informed liars would score higher than uninformed liars and uninformed truth-tellers on the dependent variables was partially supported.

Table 1 about here

The interaction effect was significant for non-salient details, $F(2, 134) = 6.26$, $p = .003$, $\eta_p^2 = .09$. Simple effects revealed that informed liars reported more non-salient details than uninformed liars and uninformed truth-tellers, and the effect size was more pronounced in the high familiarity condition, $F(2, 138) = 31.96$, $p < .001$, $\eta_p^2 = .47$, than in the low familiarity condition, $F(2, 138) = 5.57$, $p = .005$, $\eta_p^2 = .15$. Hence, Hypothesis 3 which postulated that the interaction effect would be more pronounced in the high familiarity condition than in the low familiarity condition for all dependent variables was partially supported. Lastly, uninformed liars and uninformed truth-tellers did not significantly differ in their reports in any of the familiarity

conditions. In conclusion, the results generally supported our hypotheses although significant effects were not found for all the suggested dependent variables.

Discussion

Our results suggest that liars employing counter-interrogation strategies do not always succeed in producing statements that resemble those of truth-tellers. Liars, who knew prior to committing their crime that they might be asked to provide a visuospatial statement if interviewed, provided more detailed statements than truth-tellers and liars who did not possess this knowledge. Our findings can be explained by the self-regulation theory which postulates that individuals evade a threat by using an avoidance or an escape strategy (Bauer & Baumeister, 2011). Liars may choose to exercise an avoidance strategy by withholding information and using their right to silence so that they do not incriminate themselves (Alison et al., 2014; Granhag, Clemens, & Strömwall, 2009; Moston, Stephenson, & Williamson, 1992), or they may use an escape strategy by responding in a manner that does not incriminate them by denying having committed the crime or by providing non-incriminating information only (Granhag & Hartwig, 2008). Informed liars used an escape strategy as they denied incriminating information and revealed as much information as possible about the alibi setting (DePaulo et al., 2003; Granhag & Hartwig, 2008). They may have believed that providing detailed visuospatial statements would make them appear forthcoming and honest. Therefore, the knowledge that informed liars possessed prompted them to pay more attention to the alibi setting and, consequently, to provide overly detailed statements. This deliberate strategy is in contrast with truth-tellers' reporting strategy which comprises only reporting the event as they recall it (Granhag & Strömwall, 1999; Hartwig, Granhag, & Strömwall, 2007, 2010; Vrij, Mann, et al., 2010).

The self-regulation theory also explains the finding that participants who were highly familiar with the alibi setting provided visuospatial statements that were more detailed and consistent with the alibi setting than participants who were poorly familiar with the alibi setting. Participants would have wanted to make an honest impression on the interviewer and to appear convincing and forthcoming. Participants in the high familiarity condition would have found this task easier than participants in the low familiarity condition, because they had longer exposure to the setting. These results are in line with the spatial cognition research which has shown that the more familiar individuals are with the spatial setting, the stronger their memory of it which ultimately enables them to perform well on visuospatial tasks (Prestopnik & Roskos-Ewoldsen, 2000). Nonetheless, the level of familiarity with the alibi setting does not seem to affect suspects' consistency across statements when different visuospatial tasks are implemented. It may be that as long as suspects are familiar with the alibi setting, they are able to maintain between-statement consistency, irrespective of whether they are liars or truth-tellers.

High familiarity with the alibi setting was particularly effective at increasing the number of non-salient details provided by informed liars. This suggests that the higher the number of non-salient details in suspects' statements, the more likely they are to be liars who familiarised themselves with the alibi setting and the interview technique. Nonetheless, the results also suggest that even poorly familiar but informed liars can provide more detailed statements than uninformed liars or truth-tellers. The spatial cognition literature speaks to this as it is intentional learning rather than the passive experience of the spatial context that increases one's knowledge of the setting and eventually enhances performance on relevant spatial tasks (Acredolo, 1982; Gale, Golledge, Halperin, & Couclelis, 1990). For example, actively learning directions to reach a destination in a familiar area will enhance memory more than counting on one's passive

familiarity with the area to reach that destination. In other words, even though high familiarity enhanced participants' memory representation, that does not imply that participants in this condition had excellent knowledge of the setting. It was only after liars intended to study the setting and paid close attention to it (informed liars) that their memory was enhanced and they could perform better on the visuospatial tasks. Therefore, in the event that suspects anticipate being asked to report spatial information, liars' reports can be more detailed than truth-tellers' reports. Accordingly, investigators are cautioned against the assessment of suspects' statements without considering suspect background information, such as the possible familiarity of the suspect with the alibi setting and with the interview technique.

We also found that uninformed liars did not significantly differ from uninformed truth-tellers, demonstrating that when liars and truth-tellers spend the same amount of time at an alibi setting, they provide similarly detailed and consistent visuospatial statements. These findings are in line with previous research showing that liars and truth-tellers who are equally familiar with the reported event do not differ in their statements (Blandón-Gitlin et al., 2005; Warmelink et al., 2013). Hence, it may be concluded that familiarity with the alibi setting assists liars in providing statements similar to those of truth-tellers, but getting acquainted with the interview technique enables them to provide statements that are more detailed than those of truth-tellers.

None of the consistency proportion scores differed between liars and truth-tellers even when liars used counter-interrogation strategies. The correlational analysis indicated that participants who included more non-salient details in their statements also showed higher levels of statement-alibi setting consistency and between-statement consistency. As it was informed liars who reported a high number of non-salient details, one might expect these liars to also be more consistent across statements and with the alibi setting. However, this was not the case. We

conceive that, given the high number of non-salient details provided by informed liars, their statements may have been prone to errors (i.e., inaccurately recalled items), and they were hence not capable of enhancing statement-alibi setting consistency. Similarly, informed liars may have not been able to score higher than truth-tellers on between-statement consistency, because it was difficult for them to repeat all the provided details in the second interview.

It may be argued that this proneness to errors and difficulty of repeating details among informed liars would have made their consistency proportion scores lower than those of uninformed liars and truth-tellers. We believe, however, that the similarity in consistency proportion scores between informed liars, uninformed liars, and uninformed truth-tellers does not necessarily mean that the cause of this similarity was the same for all groups. Our results showed that uninformed liars and truth-tellers have not looked closely at the restaurant, and hence it was difficult for them to recall items from the restaurant and to repeat reported items in the second interview (therefore exhibiting lower statement-alibi setting consistency and between-statement consistency). In contrast, informed liars had a stronger memory of the restaurant setting and were able to include many details in their statements. Informed liars chose to be detailed, because they might have believed that indicates honesty and truth-tellers are likely to provide detailed statements in similar situation (Harvey, Vrij, Leal, Hope, & Mann, 2017). In other words, informed liars did not seem to understand truth-tellers' metacognitive processes and may have thought the interviewer was more likely to believe them if they were detailed. Given that memory is fragile (Tulving & Thomas, 1973), the more detailed informed liars' statements were, the more they were prone to errors and hence to lower statement-alibi setting consistency. Their statement-alibi setting consistency proportion scores were not less consistent than those of uninformed liars and truth-tellers, because they had a stronger memory of the alibi setting. That

is, a strong memory of the event protects the overall quality of the statement, irrespective of a few inaccurately recalled aspects (Leins, Fisher, & Vrij, 2013). In a similar manner, informed liars were not able to repeat all the details in the second interview because they could not remember them all which ultimately lowered their between-statement consistency.

In line with previous studies which have found that instructing participants to counter the interview technique does not always assist liars in evading lie detection (e.g. Harvey, Vrij, Leal, Lafferty, et al., 2017; Nahari et al., 2014; Vrij et al., 1996), our results suggest that consistency may not be easily controlled by liars employing counter-interrogation strategies.

Limitations and Future Directions

The post-interview questionnaire showed that participants in the high familiarity condition were more motivated to convince the interviewer than participants in the low familiarity condition. It may be that participants who ordered and waited for their lunch at the restaurant found the overall experience more plausible and interactive than participants who picked up their sandwich and saw the restaurant for only a few seconds. This is corroborated by previous research on motivation demonstrating that more interactive experiences in language, education, and work contexts enhance motivation (Jauregi, de Graaff, van den Bergh, & Kriz, 2012; Keller, 1987; Nichols & Miller, 1994; Orpen, 1997). Overall, all participants were highly motivated, and they were able to include salient and non-salient details in their statements irrespective of their level of familiarity with the restaurant. Hence, motivation does not seem to have impacted performance, indicating that the familiarity manipulation was effective.

In addition, informed liars reported that they looked more closely at the alibi setting than uninformed participants which was corroborated by the results. In retrospect, this question may have been better asked prior to the interview, because reporting about an outcome increases the

perceived likelihood that the outcome occurred (*hindsight bias theory*; Fischhoff, 1975). In other words, informed liars might have thought that they looked closely at the alibi setting, because they performed well on the visuospatial tasks, and not because they looked closely at the restaurant. However, it is conceived that if they have not looked closely at the restaurant, they would not have been able to incorporate more details in their drawings than uninformed liars and truth-tellers.

The alibi setting was a public venue that was used over a period of a few months. The restaurant staff sometimes changed the location of objects in the restaurant, but we tried as much as possible to keep track of all these changes and their dates. Therefore, we were able to accurately compare the visuospatial statements with the alibi setting on the date it was provided. Fortunately, the objects that were relocated were non-salient objects. Hence, they were neither central to the statements nor did they affect the hypotheses. In forensic investigations, alibi settings may change as well, so investigators inquiring about spatial details of the alibi setting need to make sure they have knowledge of the alibi setting for the time it was visited by the suspect (i.e. on the date the crime occurred).

Only one alibi setting was examined in the current research. It is important for future studies to examine different alibi settings. It would also be interesting to replicate the study in other settings that may not be consistent with people's ordinary schemas (i.e. settings that people do not often visit). Previous research has shown that individuals often use schema-consistent information to fill in memory gaps (Brewer & Treyens, 1981; Leins & Charman, 2016). Participants in the current study may have drawn objects they know to be found in a restaurant rather than objects found in the specific restaurant they have visited. Therefore, various settings should be studied before generalising the findings to different alibi settings.

Our results suggest that liars, irrespective of their level of familiarity with the alibi setting, do not seem able to supersede truth-tellers on between-statement consistency and statement-alibi setting consistency—even when they employ counter-interrogation strategies. As liars cannot achieve very high consistency, it should not be difficult to elicit differences for consistency between liars and truth-tellers. Previous studies addressed this matter by asking participants to respond to different question formats (Deeb, Vrij, Hope, Mann, Granhag, & Lancaster, 2017; Hartwig et al., 2011) or to different report modes (Leins et al., 2012; Leins, Fisher, Vrij, Leal, & Mann, 2011) across or within interviews. The manipulations proved successful in reducing liars' consistency levels more than truth-tellers' consistency levels. Hence, more research is needed to explore questioning techniques that may reduce statement consistency in deceptive statements when liars are familiar with the alibi setting or when they are acquainted with the interview technique.

Familiarity may also be examined within lie detection settings. Previous research have examined the effect of perceived situational familiarity with the target event on veracity judgments (Reinhard, Sporer, & Scharmach, 2013). Results demonstrated that high familiarity with the target event enhanced veracity judgments. This may be explained by judges' reliance on verbal cues to deception, which are more useful and lead to more accurate judgments than nonverbal cues to deception (DePaulo et al., 2003). It may also be that familiarity with the setting makes it easier for investigators to connect together other available information about the case, which ultimately enhances judgment accuracy (Blair, Levine, & Shaw, 2010). Future research may examine this speculation, and may also test whether familiar and unfamiliar investigators are accurate when detecting lies by familiar and/or unfamiliar liars.

The current study advances our understanding of the effects of counter-interrogation strategies and familiarity with the alibi setting on visuospatial statements. The results suggest that liars employing counter-interrogation strategies do not necessarily provide statements similar to those of truth-tellers. If liars employing counter-interrogation strategies are familiar with the alibi setting, they provide statements that are more detailed than those of truth-tellers. More research is needed to develop interview techniques that enhance lie detection by eliciting differences in verbal cues to deception between liars and truth-tellers.

Endnotes

¹A technical problem allowed us to conduct the univariate analyses for the post-interview questionnaire on 68 participants only. A frequency analysis using all 144 participants revealed that 84% of the participants were highly motivated, 58% were very surprised, and 31% scrutinised the restaurant (scoring 5 or above on the 7-point scale). Seventy three percent of the participants did not anticipate they will be asked for a visuospatial statement (scoring 3 or below on the 7-point scale).

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Table 1

Means and Standard Deviations of the Dependent Variables as a Function of Veracity Information Status and Familiarity

	Salient details		Non-salient details		Between-statement consistency proportion		Statement-alibi setting consistency proportion	
	<i>M (SD)</i>	95% CI	<i>M (SD)</i>	95% CI	<i>M (SD)</i>	95% CI	<i>M (SD)</i>	95% CI
Low familiarity	12.02 (6.92)	[10.39, 13.65]	18.10 (8.24)	[16.17, 20.04]	.55 (.17)	[.50, .59]	.79 (.12)	[.76, .81]
High familiarity	17.01 (8.12)*	[15.10, 18.92]	26.36 (11.08)*	[23.76, 28.96]	.61 (.17)	[.56, .64]	.83 (.11)*	[.80, .86]
Informed liars	18.00 (8.67)**	[15.48, 20.52]	29.72 (12.30)**	[26.15, 33.29]	.61 (.15)	[.56, .65]	.84 (.10)	[.81, .87]
Uninformed liars	12.11 (6.40)	[10.26, 13.97]	18.17 (6.88)	[16.17, 20.16]	.58 (.20)	[.52, .64]	.80 (.12)	[.76, .83]
Uninformed truth-tellers	13.43 (7.46)	[11.26, 15.59]	18.81 (7.45)	[16.65, 20.97]	.53 (.16)	[.48, .58]	.79 (.13)	[.75, .83]
Informed liars								
Low familiarity	14.58 (7.56)	[11.39, 17.77]	22.46 (9.58)	[18.41, 26.50]	.57 (.15)	[.51, .64]	.80 (.12)	[.75, .85]
High familiarity	21.42 (8.48)	[17.83, 25.00]	36.98 (10.36)***	[32.60, 41.35]	.64 (.16)	[.58, .71]	.87 (.08)	[.84, .90]
Uninformed liars								
Low familiarity	10.23 (6.37)	[7.54, 12.92]	15.21 (6.05)	[12.65, 17.76]	.56 (.22)	[.47, .66]	.77 (.14)	[.71, .83]
High familiarity	14.00 (5.97)	[11.48, 16.52]	21.13 (6.47)	[18.39, 23.86]	.60 (.18)	[.52, .67]	.82 (.09)	[.79, .86]
Uninformed truth-tellers								
Low familiarity	11.25 (6.27)	[8.60, 13.90]	16.65 (7.10)	[13.65, 19.64]	.50 (.14)	[.44, .56]	.79 (.10)	[.74, .83]
High familiarity	15.60 (8.02)	[12.22, 19.00]	20.98 (7.28)	[17.90, 24.05]	.56 (.18)	[.49, .64]	.80 (.15)	[.73, .86]

*Hypothesis 1 testing: Scores higher for high familiarity than for low familiarity condition ($p \leq .031$).

** Hypothesis 2 testing: Scores higher for informed liars than for uninformed liars and truth-tellers ($p \leq .001$).

*** Hypothesis 3 testing: Score higher for informed liars than for uninformed liars and truth-tellers in the high, compared to the low, familiarity condition ($p \leq .005$).