# MEMORY-BASED LIE DETECTION IN REPEATED INTERVIEWS

The Importance of Early Use of Mnemonics

Aleksandras Izotovas

Department of Psychology

UNIVERSITY OF GOTHENBURG

Doctoral Dissertation in Psychology
Department of Psychology
University of Gothenburg
February 15, 2019


Printing: BrandFactory AB, 2019
ISSN 1101-718X avhandling/Göteborgs universitet, psykologiska inst.
ISBN: 978-91-7833-328-8 (Print)
ISBN: 978-91-7833-329-5 (PDF)

*This thesis is dedicated to my parents Sabina and Vladimir*

*"All of this, down to the smallest detail, can be explained if you wish in an entirely different way, and it would sound even more natural."* (Dostoevsky, 1866)

# ABSTRACT

The aim of this thesis was to examine how memory-enhancing (mnemonic) techniques used in an interview carried out immediately after an event affected truth tellers' and liars' responses in both an immediate interview and in a delayed interview. In Studies I-III participants took part in a mock intelligence scenario in which they were asked to take the role of an intelligence officer. They were shown a mock intelligence operation video of a secret break-in to an apartment. Participants were instructed either to tell the truth or lie about its contents in two interviews, one of which was immediately after watching the video and the other after an approximately two-week delay. The amount of visual, spatial, temporal, and action details, and between-statement consistency characteristics between the two interviews (reminiscences, repetitions, and omissions) in truth tellers' and liars' responses were analysed. In **Study I** ($N$ = 143), three mnemonic techniques were tested: Context reinstatement, Sketch, and Event-line. In the immediate interview, participants were asked to provide a free recall and then asked to give further information via one of these three mnemonics. In the delayed interview, they were only asked to provide a free recall. Truth tellers reported more visual, spatial, temporal, and action details in the immediate and delayed interviews, regardless of which mnemonic technique was used. Truth tellers experienced more of a decline in reporting details after a delay than liars, thus showing more than liars, patterns of reporting indicative of genuine memory decay. Truth tellers and liars did not differ in terms of between-statement consistency. In **Study II** ($N$ = 49), the effects of the Sketch mnemonic on truth tellers' and liars' immediate and delayed responses were examined. Unlike Study I, in this experiment a free recall phase was not included in the immediate interview. Participants were only asked to draw a sketch of the apartment of the break-in, and to describe that sketch. In the immediate interviews, truth tellers reported more visual, spatial, temporal, and action details than liars. In the delayed interviews, truth tellers reported more spatial, temporal, and action details than liars. As in Study I, truth tellers more than liars, showed patterns indicative of genuine memory decay. Between-statement consistency did not differ between veracity groups. In **Study III** ($N$ = 80), the effects of different interviewing techniques used in the immediate interview on truth tellers' and liars' delayed responses were examined. In the immediate interview participants were instructed either to report everything they remembered, or asked open-ended spatial questions related to the event.

In the delayed interview all participants were asked to report everything they could remember. Truth tellers reported more visual, spatial, temporal and action details than liars, both immediately and after a delay, regardless of the interview technique used in the immediate interview. However, in the immediate interview the differences between truth tellers and liars were larger using the report everything mnemonic than using the spatial questions. Regarding between-statement consistency, truth tellers provided more reminiscences and repetitions and made fewer omissions than liars. Participants in **Study IV** (N = 96) read the immediate and delayed statements from Study I and were asked to make veracity judgements. One group of participants was informed about the findings of Study I, and instructed to rely on these findings when making their veracity judgements. The other group was not informed about the findings of Study I. Results showed that deception detection accuracy did not differ between the informed and uninformed groups. In addition, the majority of participants in both conditions based their decisions on unreliable cues to truth/deceit. The results of this thesis demonstrate that the way an interview immediately after an event is carried has an effect on the verbal content of later interviews. Practitioners need to be aware that it is important to conduct the first interview as soon as possible after an incident, and to use interview techniques that enhance complete statements from the interviewee in order to effectively elicit differences between truthful and deceptive accounts. Differences that, in the further stages of the investigation, may lead to the detecting of deception.

# SWEDISH SUMMARY

Frågan om människans förmåga att upptäcka lögner har intresserat forskare i sekler. Det är särskilt relevant för rättsväsendet. Forskningen om effektiva sätt att upptäcka lögner i rättsväsendet är viktig av två anledningar. För det första, att frågan om vittnen eller misstänktas tillförlitlighet är viktig för bl.a. förhörsledare och domare . För det andra, att brister i förmågan att upptäcka lögner kan få oanade konsekvenser. En oskyldig person som på felaktiga grunder pekas ut som lögnare kan bli straffad för brott hon eller han inte har begått. Omvänt kan en vilseledande person som felaktigt tas för att tala sanning och därigenom undgå straff, fortsätta att begå brott. Omfattande tidigare forskning har visat att verbala tecken är mer effektiva än icke-verbala signaler för att skilja mellan sanningssägare och lögnare. Bland de mest diagnostiska verbala tecken som har visats är *mängden av detaljer* som rapporteras. Med andra ord, ju mer detaljerade svar från den intervjuade desto mer troligt är att svaren är sanna..

Det diagnostiska värdet i detaljrikedom kan påverkas av vilken förhörsteknik som används under intervjun. Forskning har visat att användningen av specifika tekniker är mer effektiva i att få fram verbala skillnader mellan sanningssägare och lögnare än de vanliga frågor/svar-förhören. En av dessa framgångsrika tekniker är minnesförstärkning, så kallade *mnemonics.* Dessa tekniker var från början skapade för att stimulera minnet hos vittnen angående de händelser de rapporterar, och i sin tur bidra till att hjälpa utredningen framåt. Tidigare studier har också visat att användningen av minnesförstärkande tekniker kan vara bra för att öka möjligheten att upptäcka lögner. Däremot finns det inte så många studier som har undersökt effekten av detaljrikedom i upprepade intervjuer, som sker under en viss tidsintervall. Syftet med denna avhandling var att undersöka hur minnesförstärkande tekniker som används i intervjuer utförda direkt efter en händelse och hur detta påverkar sanningssägares och lögnares berättelser, först i direkt anslutning till händelsen men också i en senare intervju.

Fyra olika minnesförstärkande tekniker testades experimentellt i denna avhandling: i) *Mental återetablering* som innebär att be de intervjuade att mentalt återskapa händelseförloppet och de kognitiva och känslomässiga minnena för händelsen; ii) *Händelseförlopp* handlar om att med minnesförstärkande tekniker återuppleva situationen och händelsen i ordningsföljd. Deltagarna instruerades att skriva ner händelsen så som de mindes den på en tidslinje och estimera när i tid händelserna inträffade; iii) *Skiss* innebär att göra en teckning av platsen för händelsen; och, iv)

*Rapportera allt* uppmanar de intervjuade att berätta all information de minns, även sådan som verkar oviktig. Att erinra sig specifika detaljer kan aktivera minnet av andra relevanta detaljer i händelsen.

I de studier som gjordes inom ramen för denna avhandling fick försöksdeltagare ta del av ett fingerat scenario där de ombads att agera som hemliga agenter. De visades en film som visade ett inbrott i en lägenhet. Deltagarna instruerades att antingen tala sanning eller ljuga om innehållet i filmen i två intervjuer, en som skedde direkt efter filmvisningen och den andra som tog plats efter ungefär två veckor. Mängden av visuella, rumsliga, tidsmässiga och händelsedetaljer mättes vid de båda intervjutillfällena och analyserades också med avseende på information som upprepades, lades till eller drogs ifrån (överensstämmelse) . De sanna och de falska utsagorna jämfördes med varandra.

I Studie I undersöktes tre minnesförstärkande tekniker: Mental återetablering, Skiss och Händelseförlopp. I den första intervjun tillfrågades deltagarna att inledningsvis berätta fritt ur minnet för att sedan ge mer information genom en av de tre teknikerna. I den andra intervjun uppmanades deltagarna att endast använda sig av fritt återberättande. Sanningssägare rapporterade mer visuella, rumsliga, tidsmässiga och händelse-detaljer både i den inledande och den senare intervjun oavsett vilken av de minnesförstärkande teknikerna som användes. Sanningssägarna visade en större minskning i detaljrikedom över tid än vad lögnarna gjorde, vilket visar lögnares tendenser att rapportera ett mer stabilt mönster i berättelsen och att de som talar sanning tappar viss information över tid. Det fanns ingen skillnad mellan sanningssägare och lögnare gällande överensstämmandet mellan rapporterna.

I Studie II undersöktes effekterna av Skiss-metoden vid första och senare intervjun med avseende på skillnader mellan sanningssägare och lögnare med. Till skillnad från i Studie I inkluderades inte den fria återgivningen som en del i den första intervjufasen. Deltagarna ombads att rita en skiss av lägenheten där inbrottet ägt rum och att sedan beskriva den skissen. I både de inledande och de senare intervjuerna rapporterade sanningssägarna mer visuella, rumsliga, tidsmässiga och händelse-detaljer än lögnarna.. Sanningssägarna och lögnarna visade på liknande antal visuella detaljer vid det senare intervjutillfället. Som i Studie I visar sanningssägare mer av äkta glömska än lögnare. Det fanns ingen skillnad mellan grupperna gällande överensstämmelsen i berättelserna.

I Studie III undersöktes effekterna av olika intervjutekniker . Deltagarna instruerades vid det första intervjutillfället att antingen rapportera allt de kom ihåg av händelsen eller få öppna/slutna frågor av händelseförloppet. I den senare intervjun ombads alla deltagare att rapportera allt de kunde komma ihåg. Sanningssägare rapporterade mer visuella, rumsliga, tidsmässiga och händelse-detaljer än lögnare, både i den initiala intervjun och i den senare, oavsett vilken intervjuteknik som användes i den första intervjun. Skillnaden mellan sanningssägare och lögnare i den inledande intervjun var större när ”rapportera allt du minns”-tekniken användes i förhållande till de rumsliga frågorna. Vad det gäller överensstämmelsen mellan berättelserna uppvisade sanningssägare mer tillägg än lögnarna och också mindre utelämnade av information.

I Studie IV fick deltagarna läsa berättelserna från deltagarna i Studie I (både första och det andra intervjun) och ombads bedöma om berättelserna var sanna eller påhittade. . En grupp av deltagarna informerades om resultaten av Studie I och instruerades att använda de resultaten när de bedömde om det var sant eller inte. Den andra gruppen av deltagare var inte informerade om resultaten i Studie I. Resultaten visade att förmågan att korrekt klassificera berättelserna, dvs särskilja sanningar och påhitt inte skiljde sig mellan de jämförda grupperna. Dessutom baserade en majoritet av deltagarna, i båda grupperna, sina beslut på otillförlitliga tecken på sanning och lögn.

Forskningen visade att när minnesförstärkande tekniker användes i den inledande intervjun fanns det skillnader i detaljrikedom. Denna indikator på tillförlitlighet kvarstod även vid ett senare tillfälle. Däremot visade det sig att sanningssägare minns färre detaljer i en senare rapportering än lögnare. De som talar sanning uppvisar alltså en äkta brist på att minnas detaljer, medan de som ljuger visar tecken på ” konstruerad stabilitet” i sin rapportering. Studierna är baserade på tidigare forskning som visar att både de som talar sanning och de som ljuger ofta är överensstämmande då de intervjuas vid två tillfällen. Till sist visade studierna att lekmän är dåliga på att särskilja sanning från lögn, och besitter en stark tillit till stereotypa och inkorrekta ledtrådar när de fattar dessa beslut.

Resultaten visar att minnesförstärkande tekniker som används i en första intervju direkt efter en händelse är kan öka förmågan att upptäcka lögner både i det inledande men även vid det senare intervjutillfället. Denna avhandling bidrar till förståelsen och upptäckten av verbala tecken på lögner vid återkommande intervjutillfällen.

# PREFACE

This thesis consists of a summary and the following four papers, which are referred to by their roman numerals:

I. Izotovas, A., Vrij, A., Hope, L., Mann, S., Granhag, P.A., & Strömwall, L.A. (2018). Facilitating memory-based lie detection in immediate and delayed interviewing: The role of mnemonics. *Applied Cognitive Psychology, 32*, 561–574. DOI: 10.1002/acp.3435

II. Izotovas, A., Vrij, A., Hope, L., Granhag, P. A., Strömwall, L.A., & Mann, S. (2018). *Facilitating memory-based lie detection in immediate and delayed statements: The role of sketch mnemonic*. Manuscript submitted for publication.

III. Izotovas, A., Vrij, A., Hope, L., Granhag, P. A., Strömwall, L.A., & Mann, S. (2018). *Deception detection in repeated interviews: The effects of immediate type of questioning on the delayed accounts*. Manuscript submitted for publication.

IV. Izotovas, A., Vrij, A., Strömwall, L.A., Mann, S., Hope, L., & Granhag, P. A. (2018). *Mnemonic techniques and lie detection: Accuracy of truth and deception judgments in repeated accounts.* Manuscript.

Studies I-III were part-funded by a fellowship awarded from the Erasmus Mundus Joint Doctorate Program The House of Legal Psychology (EMJD-LP) with Framework Partnership Agreement (FPA) 2013-0036 and Specific Grant Agreement (SGA) 2015-1610 to Aleksandras Izotovas.

Studies I-IV were part-funded by the High-Value Detainee Interrogation Group, DJF-15-1299-V-0010271 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.

# Table of Contents


INTRODUCTION 1
1.1 The thesis 3
1.2 Key terms and definitions 4
1.3 Interviewing approaches and deception detection 7
1.4 Verbal deception detection: Cognitive Credibility Assessment 8
1.4.1 Theoretical background 9
1.4.2 Interviewing with CCA to detect deceit 10
1.4.3 Verbal content of the statements 11
1.5 Detecting deception with mnemonic techniques 13
1.6 Memory and repeated interviewing: The role of initial interviewee's account on delayed performance 14
1.7 Detecting deception in repeated delayed interviewing 15
1.7.1 Amount of reported details in the accounts 16
1.7.2 Between-statement consistency 18
1.8 Accuracy in human veracity judgements 20
SUMMARY OF THE EMPIRICAL STUDIES 21
2.1 General and specific aims 21
2.2 Study I 24
2.2.1 Background 24
2.2.2 Method 25
2.2.3 Results and discussion 29
2.3 Study II 33
2.3.1 Background 33
2.3.2 Method 34
2.3.3 Results and discussion 35
2.4 Study III 37
2.4.1 Background 37
2.4.2 Method 38
2.4.3 Results and discussion 39
2.5 Study IV 42

2.5.1 Background 42
2.5.2 Method 43
2.5.3 Results and discussion 45
GENERAL DISCUSSION 48
3.1 Summary of the findings 48
3.2 Veracity and the immediate interviews 50
3.3 Veracity and the delayed interviews 51
3.4 Comparison between immediate and delayed statements 53
3.5 Consistency between immediate and delayed statements 54
3.6 Observers' accuracy of veracity judgements 56
3.7 Empirical and practical contributions 57
3.8 Methodological considerations and limitations 59
3.9 Future directions 61
3.10 Conclusions 63
References 65
APPENDIX

# FIGURES AND TABLES


| | | |
|---|---|---|
| Table 2.1 | Overview of the studies of this thesis | 22 |
| Table 2.2 | Instructions for the mnemonic techniques used in the thesis | 23 |
| Table 2.3 | Participants' (informed and uninformed groups combined) self-reported cues to truth/deceit and their reliability | 45 |
| Table 2.4 | Frequencies of the reliability of perceived cues in the informed and uninformed groups | 47 |
| Table 3.1 | Summary of the Cohen's *d* effect sizes for the amount of reported detail using different mnemonic techniques. A positive *d* score indicates that truth tellers reported more details than did liars | 48 |
| Table 3.2 | Summary of the Cohen's *d* effect sizes for the consistency variables between statements. Positive scores indicate that truth tellers provided more details than did liars. Negative scores indicate that liars provided more details than did truth tellers | 49 |
| Table 3.3 | Between-statement consistency characteristics as a function of veracity and mnemonic conditions across Studies I–III (without the addition of covariates) | Appendix |
| Figure 2.1 | Amount of reported visual, spatial, temporal, and action details with 95% confidence intervals in the immediate and delayed FRs across conditions | 31 |
| Figure 2.2 | Amount of reported visual, spatial, temporal, and action details with 95% confidence intervals in the *CR*, sketch, and *event-line* descriptions in the immediate interview | 32 |
| Figure 2.3 | Total amount of different details with 95% confidence intervals in the immediate and delayed statements across veracity conditions | 36 |
| Figure 2.4 | Illustration of the veracity and type of interviewing interaction effects in the delayed interview | 41 |
| Figure 2.5 | Illustration of the veracity and type of interviewing interaction effects in the immediate interview | 42 |

# ACKNOWLEDGEMENTS

I would like to express my gratitude to everyone who was with me throughout this exciting PhD journey.

My interest in legal psychology started sometime in 2006 at Vilnius University, when writing an assignment for one of my undergraduate courses. I was fascinated by the classical studies of Elizabeth Loftus. At that time, I did not even dream of the possibility of working with the most renowned researchers in the field. And this dream came true in 2015!

I would first like to thank my first supervisor at the University of Portsmouth, Professor Aldert Vrij. I feel privileged to have had the opportunity to work with you on this project. I am very grateful for your always finding time and responding very quickly to the questions, concerns, and issues I was experiencing in my research. I was always able to find a solution with your guidance. Also, I will always see you as a perfect example of a fully dedicated researcher immersed in the topic. Apart from academic matters, our discussions of the genius of music of Sigur Ros or J. S. Bach's 'Matthäus-Passion' will never be forgotten!

I am no less grateful to my second supervisor, Professor Lorraine Hope from the University of Portsmouth. Lorraine, I will be honest with you, sometimes it was difficult to swallow your comments and critical remarks on my scientific writing. But it took me just a little while to realise that those comments were fair and very helpful. I learned a lot from you about theoretical and methodological rigour. I will also remember our funny chats ('What if a professor in frog science asks a question about your research at the conference?') and your endless positivity and support, no matter what.

I would like to express huge gratitude to my supervisors at the University of Gothenburg, Professor Pär-Anders Granhag and Professor Leif A. Strömwall. The mobility period at this university was such an invaluable experience! Professor Granhag, I will be always amazed by the depth of your knowledge and your impressive insights into translating science to specific situations in the real world. I am also very thankful for your support and encouragement when I was encountering difficulties in my PhD progress. Professor Strömwall, I very much appreciate your friendliness, approachability, responsiveness, and very useful thoughts about the development of research questions and methods. Also, thank you so much for your helpful comments on my manuscripts.

I am grateful to my supervisor, Dr. Samantha Mann from the University of Portsmouth for finding time to advise me on and to review and proofread my research proposals and manuscripts. It was also fun to see and talk to you during the scientific conferences.

This wonderful PhD journey would not have been possible without the Erasmus Mundus PhD programme 'The House of Legal Psychology'. It was such an honour to be a part of this project of excellence in legal psychology. It gave me an excellent opportunity to attend and present my own research at top-level international conferences, where I also met the world's best scholars in the field. I am very thankful to the chief members Professor Peter J. van

Koppen and Dr. Robert Horselenberg not only for the opportunity to learn a lot and build expertise, but also for bringing so much fun and so many unforgettable moments to the programme. It would be unwise not to mention my former Master's supervisor at Maastricht University, Professor Harald L.G.J. Merckelbach, who introduced me to 'The House'. Thank you for encouraging me to apply to this programme. I am also very glad that I have kept in contact with you to this day!

It was a huge pleasure to meet new colleagues and make friends at 'The House', and also at the departments of psychology of the universities of Portsmouth and Gothenburg. I hope to keep in contact with all of you on our future career paths.

Huge thank to Chantal Meertens, Ann Backlund, and Linda Lindén for never leaving me alone to deal with all the administrative matters of my PhD project.

It was an honour being part of the research groups 'Hope Applied Cognition lab' (HAC lab) and 'Criminal, Legal and Investigative Psychology' (CLIP). All the presentations, discussions of scientific articles and real-life cases in our field, as well as the social activities, were invaluable.

This thesis would not have been written without funding from 'The House of Legal Psychology' and 'The High-Value Detainee Interrogation Group' (HIG) projects. Needless to say, the research would not have been conducted without the devoted assistants Ashley Foo, Benedetta Porreca, Mandy Kalandria, Lavinia Pontigia, Christina van der Tuin-Rindestig, and Jeanira Molina. Thanks for your massive contribution to this thesis!

I am also grateful to the Lithuanian Criminal Police Bureau's Training Centre for permission to use the stimulus material in the studies of this thesis. And I am very glad that I have kept in contact with my colleagues from the Lithuanian police, Sima Dirvelytė, Andrius Lošakevičius, and Marijus Mitrauskas – among others. Thanks for your support and for believing in me!

I will extend my gratitude to my closest relatives and friends for being with me throughout my PhD journey: my mother Sabina and father Vladimir, for their unconditional love; my sister Tatjana and her husband Stefano, for their care and support; my sweetest goddaughter Valentina and nephew Emmanuelle, for bringing so much joy and so many happy moments; my friend Vytautas, for helping me sometimes step aside and not give in to panic; and my other friends Andrej, Denis, Tatjana, Vytautas M., Justina Š., and P**dukai company, among others, for providing relief outside my work. Rock'n'roll! I must also thank the best possible office mates, Marc, Feni, Stefana, Pam, and Eva, for all the help, laughs, and craziness we had while working together!

Last and foremost, I wish to thank to my fiancée Justina for her endless understanding, care, and warmth. Juste, I love you very much!

Aleksandras Izotovas
Vilnius, January 2019

# INTRODUCTION

Deception is very much part of human behaviour. People lie because it is important for their survival (Goffman, 1959). Indeed, renowned German philosopher Friedrich Nietzsche argued that deception is necessary for our social existence (Nietzsche, 1896, as cited in Kaufmann, 1994). Modern research based on empirical evidence suggests that people lie to avoid bad feelings, to make a positive impression on others, to gain psychological or material advantage, and/or avoid negative consequences (DePaulo, 1992; Vrij, 2008). In forensic settings, the last motive is the most significant one. Interviewees may lie to protect themselves or others from punishment, such as many years of incarceration. Examining effective ways to detect deception in criminal justice contexts is important for two reasons. First, the question of witness or suspect credibility is important for investigative and forensic professionals (Volbert & Steller, 2014; Vrij, 2015; Zöhner, 2011). Second, poor accuracy in deception detection may have severe consequences. An innocent person wrongly identified as telling a lie can falsely be convicted for crime(s) s/he did not commit (Kassin, 2015). Conversely, a deceptive person wrongly identified as telling the truth could escape conviction and continue committing further crimes.

The main question that arises is how truths can be distinguished from lies. In the second half of the last century, research into human behaviour mostly concentrated on the non-verbal cues that could potentially indicate deception (Ekman & Friesen, 1969; Miller & Stiff, 1993; Zuckerman, DePaulo, & Rosenthal, 1981). The motive for investigating non-verbal behaviour stemmed from the common stereotypical view that lying is morally wrong (Bok, 1978; DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996; Robinson, 1994). If deception is considered morally wrong, then liars' behaviour should be accompanied by typical reactions of nervousness, for example, gaze aversion or body movements (Inbau, Reid, Buckley, & Jayne, 2001). However, several meta-analytical studies have shown that non-verbal cues to deceit are unreliable, with discrimination accuracy between truth tellers and liars typically not much higher than chance level (DePaulo et al., 2003; Masip, Sporer, Garrido, & Herrero, 2005; Sporer & Schwandt, 2006). Moreover, these studies have demonstrated that verbal cues are more accurate than non-verbal cues. One of the most diagnostic verbal cues typically found in deception research is *the amount of detail* reported (Amado, Arce, Fariña, & Vilarino, 2016; DePaulo et al., 2003; Vrij, 2008). That is, the more detailed the response of an interviewee is, the more likely it is that the response is truthful, and vice versa.

Although the amount of detail reported has been identified as one of the key cues to detecting deception, in most studies, interviews are conducted only once, typically immediately after an event (Vrij, 2008, 2016). This finding is problematic, as it calls into question whether the results so obtained apply to situations in which an interviewee is questioned on repeated occasions. Furthermore, in real-life forensic settings, the same person (crime victim, witness, suspect, or other source of information) is commonly interviewed about the same event more than once and at different points in time (Goldsmith, Koriat, & Pansky, 2005; Innes, 2000; Wysman, Scoboria, Gawrylowicz, & Memon, 2014). For example, a police officer may question the same suspect repeatedly to search for contradictions between his/her statements.

Apart from time delay and the number of interviews conducted about the event in question, the diagnostic value of the 'amount of detail' cue can be affected by the questioning technique used during the interviewing. Researchers have shown that using specific techniques is more effective in eliciting verbal differences between truth tellers and liars than standard question–answer approaches (Hartwig, Granhag, & Luke, 2014; Mac Giolla, Granhag, & Vernham, 2017; Vrij, Fisher, & Blank, 2017a). One such group of techniques, based on findings from human memory research, is called memory-enhancing techniques or *mnemonics* (Fisher & Geiselman, 1992). Examination of mnemonic techniques is important because they are typically included in evidence-based investigative interviewing guidelines (Achieving Best Evidence in Criminal Proceedings, 2011; Meissner, Surmon-Böhr, Oleszkiewicz, & Alison, 2017). Previous studies have shown that use of mnemonics can be beneficial in detecting deception (Bembibre & Higueras, 2011; Hernández-Fernaud & Alonso-Quecuty, 1997; Vrij et al., 2009). However, not many studies have focused on how mnemonics affect the amount of detail as a cue to detecting deception in repeated interviews taking place over a certain period of time. The use of mnemonic techniques in the immediate interview and the ability of these techniques to, after a delay, affect deception detection is the main focus of this research.

This thesis contains three chapters: *Introduction* presents an overview of theoretical background and empirical evidence related to the topic of this research. *Summary of the Empirical Studies* outlines the four experimental studies conducted in this thesis. Finally, the overall findings of the thesis are discussed, and empirical considerations, practical recommendations, and conclusions are presented in *General Discussion*.

### 1.1 The thesis

In this thesis, the focus is on two interviewing times: Immediate and after a two-week delay. Previous research has demonstrated that high-quality immediate interviewing can be beneficial for the delayed performance of truth tellers, for example, inoculating against forgetting or resulting in fewer errors (Borstein, Liebel, & Scarberry, 1998; Hope, Gabbert, Fisher, & Jamieson, 2014; Pansky & Nemets, 2012). This thesis seeks to expand on this knowledge by examining whether high-quality immediate interviewing (i.e., using mnemonic techniques) can also help the detection of deception after a delay.

The research conducted for this thesis was an effort to extend our theoretical and practical knowledge of deception detection in repeated interviewing across a passage of time, by using mnemonics. Regarding the theoretical perspective, the thesis contributes to the understanding of the reporting of information between immediate and delayed interviews by truth tellers and liars. Do the patterns of reporting over time differ between truth tellers and liars? In other words, is the reporting of fabricated information similar to the reporting of information retrieved from memory of genuine experience(s), over the passage of time? From a practical perspective, this thesis attempts to examine whether mnemonics used in the immediate interviews could be helpful to distinguish between truthful and deceptive responses immediately and after a two-week delay.

The thesis opens with an overview of the theoretical background and empirical evidence related to the research topic. Specifically, Chapter 1 proceeds by presenting *Key terms and definitions* (section *1.2*) associated with memory and deception theories relevant to this research. Then, in section *1.3 Interviewing approaches and deception detection*, I discuss the main investigative interviewing methods used in criminal justice systems around the world and consider their relevance to lie detection. The next two sections are related to interviewing to detect deception: In *1.4 Verbal deception detection: Cognitive credibility assessment* a theoretical rationale for the verbal differences between truthful and deceptive statements are provided, and specific

verbal lie detection interviewing techniques are introduced, and in *1.5 Detecting deception with mnemonic techniques* how using memory-enhancing techniques in interviews can contribute to verbal deception detection is reviewed. The following two sections are related to repeated interviewing. First, to understand how real memories (i.e., recollections of genuinely experienced events) are processed, section *1.6 Memory and repeated interviewing: The role of the interviewee's initial account on delayed performance* discusses how the quality of the immediate reporting of information affects the truthful interviewee's subsequent responses. Then, section *1.7 Detecting deception in repeated delayed interviewing* reviews the differences between truth tellers and liars in terms of two veracity cues: Amount of detail, and between-statement consistency. Finally, section *1.8 Accuracy in human veracity judgements* discusses previous research into laypeople's and practitioners' ability to detect truth and deceit.

## 1.2 Key terms and definitions

*Deception.* This is defined as the deliberate (successful or unsuccessful) attempt of a communicator to fabricate truthful information and present it to another person, without forewarning, for the purpose of making him/her believe that this information is true (Vrij, 2008). The terms deception, deceit, lie, or fabrication will be used interchangeably in this thesis.

*Interviewing.* In the criminal justice system, a distinction has been made between interviewing in law enforcement and intelligence-gathering settings (Evans, Meissner, Brandon, Russano, & Kleinman, 2010; Redlich, 2007). Law enforcement interviews are related to the questioning of a witness, victim, or suspect about a crime that occurred in the past. Intelligence interviews involve information gathering from a source (e.g., informant) about past, present, or possible upcoming criminal activities, which may not necessarily involve wrongdoing(s) by the source (Kelly, Miller, Redlich, & Kleinman, 2013). These two settings, law inforcement and intelligence-gathering, are not differentiated in the thesis. Verbal deception detection requires a certain level of cooperation from the interviewee (Vrij, 2015). It is impossible to assess credibility based on verbal cues when an interviewee does not say anything (e.g., when a witness claims that s/he 'does not remember anything' about the event, or a suspect exercises his/her right to remain silent). Although our studies involved intelligence-gathering scenarios as stimulus material, the research findings of the thesis could be applied to different real-life interviewing settings, as long as the interviewee produces speech.

*Mnemonic techniques.* Memory-enhancing (mnemonic) interview techniques are based on two key principles of human memory (Fisher & Geiselman, 1992). First, a memory trace has several features (e.g., visual, physical, and emotional), and the effectiveness of a retrieval cue is dependent on the amount of overlap between the retrieval cue and the encoded event (Flexser & Tulving, 1978). For example, a victim may find the name of the perpetrator difficult to remember when describing the incident, but recall it later when characterising what the offender looked like. Second, several retrieval paths to the encoded event may be available, so that information not accessible with one retrieval cue may become accessible with another (Tulving, 1974). For example, the interviewee may not report specific bystanders seen during an incident when asked a direct question, but may describe them when requested to draw a layout of that room. Four mnemonic techniques were examined across the experiments conducted for this thesis: i) *Context reinstatement (CR)* (Study I) refers to asking interviewees to mentally recreate the to-be-recalled event, as well as their physiological, cognitive, and emotional states at the time of the event (Fisher & Geiselman, 1992). They are typically asked to concentrate, shut their eyes, and 'put' themselves back in the to-be-remembered situation; ii) *Event-line* (Study I) is based on the Timeline interviewing format developed by Hope, Mullis, and Gabbert (2013), who originally used a reporting format with a physical timeline to facilitate memory retrieval regarding multiple perpetrators. The mnemonic is related to reproducing the temporal context and sequence of actions of an event. Participants are requested to write on a blank sheet of paper with a graphical line (i.e., a grid divided into time units) all actions from the event they can remember and to indicate on that line at what time these actions occurred; iii) *Sketch* (Studies I and II) refers to making a drawing of a location of the event in question (Dando, Wilcock, & Milne, 2009). Sketching allows interviewees to initiate their own contextual retrieval cues. It is important to clarify the use of the term *'sketch'* in this thesis. In the investigative interviewing literature, this mnemonic is also known as the 'sketch reinstatement of context' technique. However, in some sources, the term '*sketch'* can also be found (e.g., Hope, Gabbert, & Fisher, 2011; Rivard, Fisher, Robertson, & Mueller, 2014). In the deception literature, the term '*sketch'* (or 'drawing') is more common than 'sketch reinstatement of context' (e.g., Mac Giolla et al., 2017; Roos af Hjelmsäter, Öhman, Granhag, & Vrij, 2014; Vrij et al., 2010). Therefore, it was decided to use the former. Finally, iv) the *Report everything* mnemonic (Studies I and III) prompts interviewees to disclose all information they remember, whether or not it seems trivial, as the recall of specific details may activate memories of other relevant details (Fisher & Geiselman, 1992, 2010).

*Retrieval* and *reporting.* Retrieval is the process of recalling information from the past that has previously been encoded and stored in the memory (Reber et al., 2009). This term is not equivalent to information reporting. Reporting is characterised as verbally presenting information following the interviewer's request to do so. If an interviewee does not report specific details of a crime, this does not necessarily mean that s/he is unable to retrieve these unreported items from memory. Retrieval from memory was not examined in the thesis. This research focused on facilitating truth tellers' information reporting, and examining whether it differed from liars' reporting.

*Delay*. This is also known as the retention interval (e.g., Pansky, Koriat, & Goldsmith, 2005). Delay refers to the time from an initial exposure to a stimulus (e.g., witnessed crime) until a later request to recall it from memory (Reber, Allen, & Reber, 2009). In forensic settings, the delay time to recall the event in formal interviews can vary significantly (Read & Conolly, 2007).

*Between-statement consistency.* Consistency is defined as the quality of always behaving, performing, or happening in a similar way (Cambridge Dictionary, 2018). In interviewing in legal settings, consistency refers to the match of information within and/or between statements provided by one interviewee or a group of interviewees (Granhag & Strömwall, 1999). Four types of consistency have been identified in the literature: i) consistency between details within one statement, called within-statement consistency; ii) consistency between different statements made by one person, called between-statement consistency; iii) consistency between statements reported by different individuals about the same event, called within-group consistency; and iv) consistency between the statement and evidence, called statement–evidence consistency (Vredeveldt, van Koppen, & Granhag, 2014). As this thesis concerns repeated interviewing, only between-statement consistency was examined. Three different (in)consistency characteristics typically used in deception studies were analysed: i) information not mentioned in one statement, but added in a subsequent statement, i.e., *reminiscences*; ii) information repeated from one statement to another, i.e., *repetitions*; and iii) information omitted from one statement to another, i.e., *omissions* (Granhag & Strömwall, 2002; Granhag, Mac Giolla, Sooniste, Strömwall, & Liu-Jonsson, 2016; Deeb et al., 2017). Contradictions, a fourth characteristic, do not occur often enough in most experimental deception research, and were therefore not included in the analyses here (Granhag et al., 2016).

This thesis is about the role of mnemonic techniques in detecting deception in legal contexts. Credibility assessment in criminal investigation is usually inseparable from interviewing witnesses or suspects. If special equipment (e.g., a polygraph) is not available, interviewee's questioning is the most common way to attempt to elicit differences between truthful and deceptive responses (Vrij et al., 2010). Therefore, it is particularly important to briefly review different interviewing approaches commonly used in criminal investigations, and their relation to deception detection. Two dominant approaches to interviewing in legal settings worldwide have been identified: *confession-oriented* (Inbau, Reid, Buckley, & Jayne, 2013) and *information-gathering* techniques (Bull & Soukara, 2010; Meissner et al., 2014). These are discussed in the section below.

### 1.3 Interviewing approaches and deception detection

The first questioning approach focuses on obtaining a confession from the suspect. Confession-oriented techniques were derived from the psychological notions of social influence and persuasion (Zimbardo, 1967). The best known confession-oriented interviewing method is the Reid technique, created in 1947 by police officer John Reid in the United States, and revised repeatedly since then (Inbau et al., 2013). It typically includes accusations, manipulations, leading questions, and other psychologically coercive methods. With respect to deception, the Reid technique suggests that innocent and guilty suspects display different non-verbal responses during a pre-interrogation interview, called the Behavioral Analysis Interview. Suspects in denial (e.g., liars) should display more signs of nervousness, such as fidgeting or gaze aversion (Inbau et al., 2013). However, such claims are inconsistent with scientific research, which has found no relationship between non-verbal cues and deception (DePaulo et al., 2003; Vrij, 2008; Vrij, Mann, & Fisher, 2006). Examining verbal cues to deceit, which has proved more effective than examining non-verbal cues (DePaulo et al., 2003; Vrij, 2008), may be complicated in this approach, because the Reid technique encompasses interruptions and leading closed-ended questions with the only possible answers being 'yes' or 'no'. Simply put, this technique offers little opportunity to elicit full answers about what happened from an interviewee, which makes the analysis of verbal content difficult (Vrij et al., 2017b). Overall, confession-oriented approaches lack sound theoretical rationale and empirical evidence and, moreover, are controversial, because they do not meet ethical standards, are linked with false confessions, and are ineffective in terms of detecting deception (Hartwig, Luke, & Skerker, 2016; Meissner et al., 2014; Vrij et al., 2017b).

The second approach, information-gathering, originated in England and Wales. After highly publicised cases of wrongful convictions, the legal framework called the Police and Criminal Evidence Act (PACE) was introduced in 1984. This legal act imposed restrictions on the detention, treatment, and questioning of suspects in police custody, and introduced mandatory tape recordings of all interrogations (Code C and Code E) (Ozin & Norton, 2015). This approach differs from confession-based interviewing in that it focuses on yielding as much information as possible. In other words, the goal of information-gathering interviewing is to establish an account of what has happened. In this approach, the questioning of suspects is similar to that of victims and witnesses: It is intended to aid investigators in generating an accurate and complete picture of what has happened (Hartwig et al., 2016). Interviewing techniques related to information gathering are ethical and based on empirically tested theories of human communication, conversation management, and the psychology of memory (Clarke, Milne, & Bull, 2011). The best known information-gathering interviewing method is called the PEACE model, an acronym identifying five stages of an interview: Planning and preparation, Engage and explain, Account, Closure, and Evaluation (Milne & Bull, 1999). The PEACE model is widely accepted in Western Europe and in some countries outside Europe (e.g., Australia, New Zealand, and Canada) (Snook, Eastwood, Stinson, Tedeschini, & House, 2010). It is non-accusatory, focusing on the importance of honesty, rapport building, active listening, and appropriate questioning in searching for the truth (Oxburgh, Fahsing, Haworth, & Blair, 2016). With respect to verbal deception detection, information-gathering interviewing is more useful than the confession-based approach for verbal lie detection purposes, since the former produces longer and uninterrupted statements. These may subsequently be used to infer the interviewee's credibility.

Interviewing techniques (including mnemonics) that fit the PEACE model have been created or adapted for verbal lie detection purposes (Vrij et al., 2017b). The next section will provide the theoretical background of verbal differences between truth tellers and liars, and will introduce specific interviewing techniques that contribute to effective deception detection.

## 1.4 Verbal deception detection: Cognitive credibility assessment

### 1.4.1 Theoretical background

Before introducing specific interviewing techniques to detect deception, it is relevant to explain the theoretical underpinning regarding differences between truth tellers and liars. The theoretical rationale is based on the assumption that truth tellers and liars have different mental states during

an interview (Granhag & Hartwig, 2015; Vrij, 2008). The approach, called cognitive credibility assessment (CCA; Vrij, 2018), proposes that in interview settings, lying is typically more mentally demanding than is truth telling (Buller & Burgoon, 1996; Zuckerman et al., 1981), and that this difference can be enhanced and exploited through specific interventions (Vrij, 2008, 2015). Elements that contribute to a liar's enhanced cognitive load are preparing a convincing story (Hartwig, Granhag, & Strömwall, 2007), suppressing the truth (Verschuere, Spruyt, Meijer, & Otgaar, 2011), remembering what was said earlier (Granhag & Strömwall, 1999), controlling verbal and non-verbal behaviour (Baumeister, 1998; DePaulo & Kirkendol, 1989), monitoring the interviewer's reactions (Buller & Burgoon, 1996; Schweitzer, Brodt, & Croson, 2002), reminding oneself to act and role play (DePaulo et al., 2003), and justifying one's lies (Levine, Kim, & Hamel, 2010).

Regarding the amount of detail reported, truth tellers often provide more details than do liars (Amado et al., 2016), caused by the different strategies used by truth tellers and liars in interviews (Hartwig et al., 2007). Truth tellers typically employ a forthcoming strategy to achieve the goal of being believed (Granhag & Hartwig, 2008). They may hold a belief in a just world (Lerner, 1980), which suggests that the world is fair and that people receive what they deserve. Therefore, truth tellers may believe that if they are forthcoming, they will be believed (Feather, 1999). In addition, according to the illusion of transparency (Gilovich, Savitsky, & Medvec, 1998; Savitsky & Gilovich, 2003), people believe that their true feelings and intentions will be apparent to others. Therefore, by being forthcoming, truth tellers may believe that their honesty will be evident to the interviewer. Liars also share the goal of being believed during the interview, but they do not take their credibility for granted. Therefore, they employ counter-interrogation strategies to achieve their goal (Hartwig et al., 2007). Liars tend to experience an information-management dilemma (Granhag & Hartwig, 2008). Feigning memory loss or providing only 'I don't know' answers will not give leads to investigators, but may hamper their credibility because it results in statements that lack detail. Therefore, liars need to provide details to make a convincing impression, but they need to withhold from reporting certain details to avoid the risk of getting caught.

Counter-interrogation strategies used by liars can be understood through the lens of self-regulation theory (Carver & Sheier, 2012). The psychology of self-regulation refers to the conscious personal management of processes (i.e., thoughts, behaviours, and feelings) aimed at controlling and directing the person towards desired goals or away from undesirable outcomes

(Fiske & Taylor, 2008). The desired goal of a liar is to convince the interviewer that the statement is true, and the undesired outcome is to get caught lying. It can be argued that, under some circumstances, truth tellers can also experience an information-management dilemma during interviews. For example, an innocent person suspected of rape can avoid mentioning that s/he was indeed flirting, because such information could raise suspicion. However, research into individuals with and without criminal histories has shown that truth tellers were more likely to use forthcoming strategies, and liars more commonly used counter-interrogation strategies (Granhag & Hartwig, 2008).

### 1.4.2 Interviewing with CCA to detect deceit

Probably the two main interviewing approaches to elicit differences between truth tellers and liars identified in the literature are: the strategic use of evidence (SUE; Granhag & Hartwig, 2015) and CCA (Vrij, 2018). The SUE interviewing technique is based on the idea of asking questions related to the evidence without making the interviewee aware that the investigator possesses this evidence. In this thesis, I will focus on CCA because using mnemonics is related to this verbal lie detection interviewing approach.

CCA comprises three interviewing techniques: *Imposing cognitive load*, *asking unexpected questions*, and *encouraging interviewees to say more* (Vrij, 2018). Imposing cognitive load refers to situations in which investigators can exploit the different mental states of truth tellers and liars by making interview settings cognitively more challenging. For example, interviewees can be asked to engage in a concurrent second task when reporting the event (e.g., telling what happened while gripping an object; Visu-Petra, Varga, Miclea, & Visu-Petra, 2013). The mental resources of liars are more depleted than those of truth tellers. Therefore, they tend to be less able to cope with additional requests than are truth tellers (Debey, Verschuere, & Crombez, 2012). Another technique, asking unexpected questions, is based on the assumption that liars prepare themselves to answer the questions they expect to be asked (Hartwig et al., 2007). Therefore, liars experience more difficulties when responding to unexpected than to expected questions or tasks, whereas truth tellers answer either with similar ease because they rely on their real experiences (Lancaster, Vrij, Hope, & Waller, 2013). Finally, the technique of encouraging interviewees to say more is related to creating a setting in which interviewees are encouraged to provide more details. Truth tellers then tend to report more details than do liars, because liars are not inclined to say much out of fear that the additional details they report will

give leads to investigators and hence give their lies away (Granhag & Hartwig, 2008; Nahari, Vrij, & Fisher, 2014).

Using mnemonics is part of the CCA approach to encouraging interviewees to say more. A recent meta-analysis examining the effectiveness of the CCA approach (Vrij et al., 2017a) showed that techniques encouraging interviewees to say more produced better discrimination between truth tellers and liars than did standard interviewing approaches.

### 1.4.3 Verbal content of statements

To examine differences between truth tellers and liars using the CCA approach, the verbal content of their reports is analysed. Statements provided by interviewees contain different types of detail. Two most widely used and scientifically examined statement analysis tools are criteria-based content analysis (CBCA; Steller & Köhnken, 1989) and reality monitoring (RM; Johnson & Raye, 1981). CBCA is based on the hypothesis, originally stated by German psychologist Udo Undeutsch, that a statement derived from memory of an actual experience differs in content and quality from a statement based on invention or fantasy, known as the Undeutsch hypothesis (Undeutsch, 1967). The tool consists of 19 criteria (e.g., *logical structure*, *contextual embeddings*, *quantity of details*, and *descriptions of interactions*), and trained evaluators judge presence or absence of them (Vrij, 2008, 2015). The core idea of CBCA is that the presence of each criterion strengthens the hypothesis that the statement is based on genuine personal experience. Although the tool was genuinely designed to be applied to assess children's credibility when they may be victims of sexual abuse, it also has applications for adult witnesses or suspects (Vrij, 2008). CBCA is used as evidence in court, for example, in Germany. Another tool, RM, is the detail scoring method typically used in deception studies (Vrij, 2015). The core idea of RM is that memories of real experiences differ from memories based on imagination (Johnson & Raye, 1981). Genuine experiences are obtained through perceptual processes and are therefore likely to contain sensory (e.g., visual, auditory, and olfactory), contextual (e.g., spatial and temporal), and affective (i.e., details of people's feelings) information. Such memories are usually expressed in a clear and vivid manner. In contrast, recollections of imagined events originate from an internal source, and are therefore likely to involve cognitive operations, such as thoughts and reasonings (e.g., 'I must have stayed at home that day as I was waiting for a parcel delivery'). Memories of imagined events are typically vaguer and less concrete (Vrij, 2008, 2015). In the studies of this thesis, the statements were analysed using RM because this tool is based on memory theory.

RM deception researchers have argued that truth tellers' reports are based on real memories and liars' reports on imagined memories. Experimental research using the RM tool has found differences between truth tellers and liars in terms of reporting RM criteria (Masip et al., 2005; Oberlader et al., 2016; Vrij, 2008). Specifically, it was found that truth tellers reported more perceptual, spatial, and temporal information than did liars. However, the RM tool has an important limitation. The main assumption of this concept is related to differentiation between real experiences and imagined events, yet it is known that not all lies are complete fabrications that a person did not at some time experience (Vrij, 2008, 2015). A liar can describe an actually experienced event by just changing and/or omitting certain crucial details. For example, a suspect can tell the truth about spending the night in a bar, but avoid mentioning his/her involvement in the fight there. Or someone can report an event (e.g., going to a restaurant) completely and truthfully but lie about when the visit to the restaurant occurred. Research has shown that liars tend to include truthful elements in their stories (Hartwig et al., 2007; Harvey, Vrij, Leal, Hope, & Mann, 2017), and the more truthful a deceptive statement is, the more difficult it can be for RM to distinguish such a deceptive statement from an entirely truthful statement.

In studies examining the CCA approach, RM details have often been analysed (Lancaster et al., 2013; Porter et al., 2018; Vrij et al., 2009). Four types of RM detail were used in this thesis to examine reports from truth tellers and liars: *Visual details*, specific items/descriptions of items seen by the interviewee (e.g., 'table', 'phone', or 'wallet'); *spatial details*, information about locations or spatial arrangements of people or objects (e.g., 'to the left', 'behind', or 'upstairs'); *temporal details*, information referring to the sequence and duration of activities, or information about when something happened (e.g., 'at the beginning', 'for five minutes', or 'it was late evening'); and *action details*, information about the actions carried out by people during the event (e.g., 'picked up', 'walked', or 'talked to her'). Other types of RM detail were not examined because they were absent from the stimulus material (e.g., auditory, olfactory, and tactile details) used in the studies of this thesis, or found to be unreliable for distinguishing truthful and deceptive statements in previous deception research (e.g., cognitive operations; Masip et al., 2005). In the next section, I turn to how mnemonic techniques can contribute to effective deception detection in terms of the different types of detail reported.

### 1.5 Detecting deception with mnemonic techniques

Specific mnemonic techniques were created to improve investigative interviewing with cooperative witnesses (Fisher & Geiselman, 1992). Research over the last few decades has shown that, compared with standard interview approaches, the cognitive interview (CI) – which consists of mnemonic techniques – increased the amount of correct information obtained from interviewees without the cost of an increased error rate (Köhnken, Milne, Memon, & Bull, 1999; Memon, Meissner, & Fraser, 2010). Given these documented benefits of using memory-enhancing techniques with truthful individuals, it can be hypothesised that these techniques could also be effective in detecting deception. The rationale behind this assumption is that using mnemonics should help truth tellers to report more information, whereas it should not result in the same amount of additional information from liars because they typically face information-management issues during interviews, as described above.

Previous findings have indicated that the use of mnemonics may differentiate between truthful and deceptive statements. In one study, truth tellers and liars were interviewed using either the CI or a standard interview protocol that did not contain mnemonics (Hernández & Alonso-Quecuty, 1997). Truth tellers reported more spatial, temporal, and sensory details than did liars, particularly when the CI was used. In another study, results suggested that the CI was more effective than a standard interview in discriminating between truth tellers and liars when examining action and object details (Bembibre & Higueras, 2011). In a recent study using three different samples from Russia, the USA, and the Republic of Korea, the instruction to sketch while narrating the story produced more new details from truth tellers than liars, whereas no difference was found between veracity groups in the reporting of details when no instruction to sketch was given (Vrij et al., 2018). Some other studies have demonstrated the effectiveness of the CI in detecting deception, although they did not include comparison (control) groups. For example, in a study in which interviewees were questioned in a CI one week after a mock theft event, truthful accounts contained more details than did deceptive accounts (Colwell, Hiscock-Anisman, Memon, Taylor, & Prewett, 2007). In another study, when the *CR* and *report everything* mnemonics were used, temporal and auditory details were more frequent in truthful than deceptive accounts (Memon, Fraser, Colwell, Odinot, & Mastroberardino, 2010). Recently, a version of the CI adapted for use with suspects by Geiselman (2012) was examined (Logue, Book, Frosina, Huizinga, & Amos, 2015). This version contained the *sketch* mnemonic. Truth tellers reported more visual, spatial, temporal, auditory, cognitive, and affective details than did liars. In summary, previous findings suggest that mnemonics can aid in effective discrimination

between truthful and deceptive accounts. As this thesis focuses on deception detection using mnemonic techniques in repeated interviewing, it is first important to discuss how the quality of immediate interviewing affects the memories of truth tellers in delayed interviews.

### 1.6 Memory and repeated interviewing: The role of the interviewee's initial account on delayed performance

Immediate interviewing is relevant because items of information are more accessible in interviewees' memory shortly after an event than after longer periods of time. From early memory research it is known that learned information tends to be forgotten over time when there are no attempts to retain it (Ebbinghaus, 1885/1913; Lawson & London, 2015; Turtle & Yuille, 1994). When the information has not been 'used' (retrieved), memory traces weaken and the amount of recalled information can systematically decrease after a time delay (Pansky et al., 2005; Rubin & Wenzel, 1995). Different studies have shown a significant decrease in recalled information in the absence of retrieval practice (Evans & Fisher, 2011; Odinot & Wolters, 2006; Schacter, 1999). Retrieval practice, or the testing effect, refers to an act of recalling to mind a previously experienced event or learned information (Roediger & Butler, 2011). Research has shown that memory testing soon after an event may have the beneficial effects of 'inoculating' witness memory against forgetting (Bornstein, Liebel, & Scarberry, 1998; Gabbert, Hope, & Fisher, 2009; Pansky & Nemets, 2012).

The quality of immediate recall can also influence the reporting of information later on. The spreading activation theory of memory suggests that memory functions as a network system with associative links (Anderson, 1983). The activation of specific items during retrieval strengthens the memory traces of these items. Moreover, memories of associated but not practiced pieces of information are also strengthened. An immediate, high-quality recall enhances subsequent recall attempts from episodic memory because it strengthens the activation levels of items and the associations between them (Anderson, 1983). Hence, the more information is presented at the immediate attempt, the more it is accessible at the repeated retrieval attempts. Conversely, incomplete initial recall attempts can impair later recall. Specifically, if an initial account of the interviewee contains little detail, the quantity of information may be impeded in his/her delayed account because of the reduced accessibility of information that was not recalled initially (Hope et al., 2014; Levy & Anderson, 2002). Thus, if initial accounts are not as complete as possible, there is a risk of substantial loss of information when the event is reported on later occasions (Macleod, 2002). In interviewing settings, this can

result in impaired interviewee memory of the important information concerning a case (Shaw, Bjork, & Handal, 1995).

Previous research has demonstrated that appropriate immediate interviewing can help elicit more information and produce fewer errors from the interviewee. A study of police call centre handlers found that the *report everything* instruction elicited significantly more information from interviewees than did either the 'five Wh- questioning strategy' or a control condition (in which they were simply asked to provide brief details of the incident), with no differences in the accuracy rates of reported information across conditions (Pescod, Wilcock, & Milne, 2013). Previous studies also found that interview formats that elicit high-quality (i.e., complete and accurate) initial accounts enhanced the amount and accuracy of information reported after a delay. For example, in one experiment, participants viewed a film about an attempted car break-in (Gabbert et al., 2009). Half the participants provided initial reports using the self-administered interview (SAI) tool comprising five different sections of instructions (i.e., *CR*, *report everything*, person descriptions, *sketch*, and other information) that were designed to facilitate the reporting of information. The rest of the participants were not interviewed immediately. When all participants were asked to complete a free recall test after a one-week delay, the SAI group reported more information than did the witnesses without an initial interview. However, a limitation of this study was that it did not contain any other immediate interview format as a comparison to the SAI. In a follow-up study addressing this issue (Hope et al., 2014), mock witnesses either initially provided an account using the SAI, or made a free recall, or did not report information. All participants were then interviewed using the CI after one week. The initial accounts of participants were more complete using the SAI than free recall. Also, the SAI group provided more detailed accounts after the delay than did participants in the other two conditions. Overall, scientific evidence has indicated that immediate and high-quality interviewing can be beneficial for the delayed interviewees' memory performance.

### 1.7 Detecting deception in repeated delayed interviewing

I will next discuss lie detection in the context of repeated interviews with respect to two cues typically examined in verbal deception research: *Amount of detail* reported in a statement, and *between-statement consistency* (Amado et al., 2016; Vredeveldt et al., 2014; Vrij, et al., 2017b).

### 1.7.1 Amount of reported detail in the accounts

Only a few deception studies have examined the amount of detail in repeated statements that were reported over different periods of time. In one study, participants witnessed a staged robbery (Granhag & Strömwall, 2002). They were interviewed three times about that event: on the same day as the robbery, after four days, and after seven days. The results showed no differences in the number of visual, temporal, auditory, and location details reported by liars versus truth-tellers in any of the three interviewing sessions. In another study, pairs of truth tellers and pairs of liars were tasked with having lunch together or creating a story of having had lunch together (Granhag & Strömwall, & Jonsson, 2003). They were interviewed immediately after the alleged lunch and again after a one-week delay. Truthful statements contained more information than did deceptive statements during both interviews. A limitation of those studies was that the participants were not tasked with doing their best to be believable during the interviews, a condition necessary to mirror real-life situations. Research has shown that truthful responses differ from deceptive responses more when interviewees are motivated to be believed (DePaulo et al., 2003). In a more recent study in which this motivation requirement was met, participants were asked either to carry out non-criminal activities (truth tellers) or to commit a mock theft that, during the interview, they then should deny having committed (liars) (Nahari, 2018). In a condition in which suspects were interviewed repeatedly, truth tellers reported more perceptual and contextual details than did liars, both immediately and after a two-week delay. In general, given the findings of these few studies, it is difficult to form any conclusions about the role of immediate interviewing in detecting deception after a delay.

Although the effects of immediate interviewing on lie detection in repeated responses are unknown, there is research evidence about the negative effects of *delay* (without immediate testing) on deception detection. In one study, pairs of participants were asked either to have lunch together (truth tellers) or to commit a mock theft and then create an alibi of having had lunch together (liars) (Vrij et al., 2009). Participants were interviewed either immediately or after a one-week delay. Results showed that truthful pairs reported more details than did deceptive pairs in the immediate interview; however, this difference was no longer significant in the delayed interview. Similarly, in a recent study in which participants carried out a mock intelligence operation, it was found that truth tellers reported more details than did liars when they were interviewed immediately, but that there was no difference in the amount of detail after a three-week delay (Harvey et al., 2017). Nahari (2018) found that truth tellers displayed larger variability than did liars in the amount of detail they reported across different delay periods.

Specifically, truth tellers provided more information when they were interviewed immediately than when they were interviewed two weeks after the event. However, liars reported a similar amount of detail, regardless of the retention interval between the incident and the interview. Moreover, some studies have shown that delay can negatively affect the efficacy of credibility assessment tools. For example, when examining the accuracy of discriminating truth tellers from liars using physiological electrodermal measures and symptom validity tests (Nahari & Ben-Shakhar, 2011), it was found that the tools were more effective in detecting truth tellers and liars for the reporting of peripheral (i.e., unrelated to the crime) details when participants were tested immediately than after a one-week delay. In another study, the verbal quality of statements provided by truth tellers and liars was assessed using two credibility tools, RM and criteria-based content analysis (CBCA; Steller & Köhnken, 1989) (McDougall & Bull, 2015). Truthful statements achieved higher RM and CBCA scores than did deceptive statements, but only when interviews were conducted shortly after the mock crime event. The RM and CBCA scores did not differ across veracity conditions when interviewees were questioned after 7–10 days.

Overall, previous research suggests that a time delay between an event and interview may hamper discrimination between truthful and deceptive accounts based on the amount of provided detail. A possible explanation for this is that delay affects the memories of truth tellers, i.e., they remember less information over time, but that fabricated accounts do not depend to the same extent on the passage of time after the event, because liars have the opportunity to fabricate information. A study by Nahari (2018) demonstrated that liars were less dependent on time delay than were truth tellers. Specifically, when liars incorporated truthful elements in their stories they also experienced a decline in truthful details after the delay. However, liars fixed the problem by adding false (unverifiable) details to their stories to make an honest impression (Nahari, 2018). Liars' tendency to add details could be explained by 'the stability bias'. Liars typically experience difficulties in understanding the real nature of memory, including the effects of time delay (Harvey et al., 2017). It is more important for liars to take into account that a sufficient amount of detail in their story is an important factor in order to be believed by the interviewer (Hartwig et al., 2007; Nahari et al., 2014). Therefore, they may be unwilling to reduce the amount of detail after the delay below a threshold perceived as necessary to appear genuine. A solution is to add fabricated details.

If the passage of time does not affect the quantity of detail liars report, it is worth exploring ways to facilitate truth tellers report more information and thus maintain richness of detail as a

diagnostic credibility cue even after a delay. In this thesis, we investigated whether using mnemonic techniques in the immediate interview can this potential in detecting deception after a delay.

### 1.7.2 Between-statement consistency

When an interviewee is questioned several times about one incident, the question of consistency between his/her statements is often raised by legal professionals (de Keijser, Malsch, Kranendonk, & de Gruijter, 2011; Granhag & Strömwall, 2001; Krix, Sauerland, Lorei, & Rispens, 2015). Practitioners tend to believe that consistency is an indicator of truthfulness, and inconsistency a sign of lying (Bogaard, Meijer, Vrij, & Merckelbach, 2016; de Keijser et al., 2011). However, research has revealed that truth tellers are equally consistent as or even less consistent than liars (Vredeveldt et al., 2014). For example, in an experiment with pairs of suspects, no differences were found between truth tellers and liars in terms of the number of reported repetitions and omissions, though truth tellers reported more reminiscences than did liars (Granhag et al., 2003). Other research has shown that truth tellers were equally consistent as or less consistent than liars when interviewees were children (Strömwall & Granhag, 2005), when the interviewee was or was not very familiar with the environment of the event (Deeb et al., 2017), or when suspects were interviewed about future intentions (Granhag et al., 2016).

A theoretical rationale accounting for liars' tendency to be consistent between their statements was proposed by Granhag and Strömwall (1999): the *repeat versus reconstruct hypothesis.* According to this hypothesis, liars believe that being consistent is important in order to make an honest impression. Liars are therefore keen to repeat their original story when they are interviewed again. In contrast, truth tellers are less concerned with what they reported in previous interviews. They try to remember the event in question again when asked about it and, due to the reconstructive nature of human memory, add, omit, or alter details in the repeated interview (Baddeley, Eysenck, Anderson, & Anderson, 2009; Loftus, 2003). Specifically, repeated retrieval attempts may lead to the recall of previously inaccessible memories, although some previously remembered information may also likely be unreported. In sum, the repeat versus reconstruct hypothesis suggests that the 'repeat' strategy used by liars during interviews should promote consistencies, and the 'reconstructive' nature of truth tellers' reporting of information should promote various inconsistencies between responses (Odinot & Wolters, 2006; Roediger, McDermott, & Goff, 1997; Turtle & Yuille, 1994).

Liars can be less consistent than truth tellers when specific interviewing techniques are used (Vredevelt et al., 2014), often related to imposing a cognitive load on the interviewee (Vrij, 2008, 2015). For example, research suggests that liars become less consistent than truth tellers when the questioning format changes between interviews (Deeb et al., 2017; Leins, Fisher, & Vrij, 2012). In one experiment, truth tellers were requested to enter a room and perform a few tasks, whereas liars were asked to pretend and convince the interviewer that they had performed the same tasks as the truth tellers (Leins et al., 2012). Participants were interviewed twice, and were asked to report information either verbally or through sketching the scene. Liars were less consistent than truth tellers between the interviews, and this difference was larger when the modalities changed from the first to the second interview (i.e., verbal–sketch, or vice versa). In a recent study, participants were interviewed twice about two mock intelligence events (Deeb et al., 2017). Truth tellers were asked to describe both events truthfully, whereas liars were asked to tell the truth about one event but to lie about the other event. Three different interview formats were used in the study: a request to provide a free recall, questions about one event at a time, or questions about the two events in random order. Participants were interviewed repeatedly using either the same (provide free recall twice) or different interview formats (first free recall, then either sequential or random-order questions). Liars were less consistent, i.e., reported fewer repetitions, when interviews changed from free recall to randomly ordered questions about the two events. These findings can be explained in terms of cognitive flexibility (Leins et al., 2012). As truth tellers' statements are based on real memories, which are typically multi-dimensional, their ability to report details consistently should not be constrained by the interviewing format. However, liars' cognitive flexibility should be affected by the interview format. Specifically, when questioning formats are the same across interviews, liars should not experience difficulties in maintaining their 'repeat' strategy in order to be consistent. However, when the modalities differ between interviews, liars should have more difficulty using this strategy, constraining consistency between the statements. In sum, previous research suggests that truth tellers can be equally consistent as or less consistent than liars when the interviewer employs the same questions/instructions across the interviews. However, liars may experience more difficulties being as consistent as truth tellers when questioning is not identical across the interviews.

In this thesis, not only the effects of mnemonic techniques on eliciting differences between truth tellers' and liars' responses were of interest, but also the ability of observers to detect these differences. The following section discusses the accuracy of human judgements about truths and lies.

### 1.8 Accuracy in human veracity judgements

In real life, practitioners make credibility judgements based on the statement(s) provided by the interviewee and on facts from the case file. If statistical analyses indicate that using specific interviewing techniques is effective in distinguishing truth tellers from liars, this does not necessarily mean that these differences will be detected by an interviewer with the same success in a particular interview. Researchers have shown that both laypeople and professionals are typically poor at detecting lies, with accuracy rates not much higher than chance (Bond & DePaulo, 2006). One reason for this low accuracy is that most cues to deception are weak, and people tend to make veracity judgements based on these unreliable cues (Global Deception Research Team, 2006; Hartwig & Bond, 2011; Vrij, 2008).

Detection of deception can improve when people rely on the correct verbal cues. One study found that police officers' accuracy rates were positively associated with their decisions having been based on content-related cues (Mann, Vrij, & Bull, 2004). Another study showed that undergraduate students and police officers with better insight into verbal cues to deception increased their accuracy in identifying truthful statements (Bogaard & Meijer, 2018). A recent meta-analysis showed that training about cues to deception improved lie detection accuracy, but only if the training was based on verbal content cues (Hauch, Sporer, Michael, & Meissner, 2016). Finally, a study in which some college students and police officers were coached to look at consistencies or evasive answers in repeated statements (Masip et al., 2018) found that coached participants performed better in identifying truthful and deceptive statements than did uninstructed individuals.

To summarise the introduction of this thesis, scientific evidence has demonstrated that specific interviewing techniques (e.g., mnemonics) have proved to be effective in verbal lie detection. However, such benefits are typically achieved when an interview is conducted shortly after the event in question. A time delay between an incident and the first interview can impair differentiation between truth tellers and liars with respect to the amount of reported information. Not much is known about how mnemonic techniques used in the immediate interview can affect the delayed statements of truth tellers and liars. In addition, it is important to extend our knowledge of the between-statement (in)consistency of truth tellers and liars, and of observers' lie detection accuracy in the context of using mnemonics in repeated interviewing.

# SUMMARY OF THE EMPIRICAL STUDIES

## 2.1 General and specific aims

This thesis had four general aims: i) to examine how mnemonic techniques used in the immediate interview affected immediate and delayed statements of truth tellers and liars; ii) to assess how the amount of detail reported changed between immediate and delayed interviews in truthful and deceptive statements; iii) to examine the consistency of truth tellers' and liars' statements across interviews; and iv) to examine the extent to which observers can distinguish truths from lies in repeated statements, when applying mnemonic techniques in the immediate interview.

In the experimental studies (Studies I–III), participants were interviewed twice: immediately after the event and after a two-week delay. Different mnemonic techniques were employed in the immediate interviews. Regarding the specific aims, Study I investigated how three mnemonic techniques (i.e., *context reinstatement* [*CR*], *sketch*, or *event-line*) employed in an interview conducted immediately after an event affected truth tellers' and liars' responses when they were interviewed again after a two-week delay. The aim of Study II was to assess how the *sketch* mnemonic technique affected truthful and deceptive immediate and delayed statements. The aim of Study III was to examine how two different types of interviewing (i.e., the *report everything* mnemonic vs. spatial open-ended questions) used in an interview conducted shortly after an event affected truth tellers' and liars' responses when they were interviewed again after a two-week delay. In Studies I–III, the number of visual, spatial, temporal, and action details, and the number of consistency characteristics (i.e., reminiscences, repetitions, and omissions), were analysed in the statements of truth tellers and liars. Finally, the aim of Study IV was to examine whether the differences between truth tellers and liars found in Study I could be accurately detected by participants who read the statements of that study. Table 2.1 presents an overview of studies conducted in the thesis, while Table 2.2 presents the instructions for each mnemonic technique given to participants.

In this chapter, summaries of the findings of the studies conducted are provided. For the exact descriptions of statistical analyses used and exact values obtained for each of the analyses, see the attached studies in the Appendix.

Table 2.1

*Overview of the studies of this thesis*

| **Study No.** | ***N*** | **Location** | **Independent variables** | **Dependent variables** |
|---|---|---|---|---|
| I | 143 | University of Portsmouth, United Kingdom | Between-subject factors:<br>- *veracity* (truthful vs. deceptive)<br>- *immediate mnemonic* (*context reinstatement* vs. *sketch* vs. *event-line*)<br><br>Within-subject factor:<br>- *time of interview* (immediate vs. delayed) | Types of detail: *visual*, *spatial, temporal*, and *action* details<br><br>Between-statement consistency: *reminiscences*, *repetitions*, and *omissions* |
| II | 49 | University of Portsmouth, United Kingdom | Between-subject factor:<br>- *veracity* (truthful vs. deceptive)<br><br>Within-subject factor:<br>- *time of interview* (immediate vs. delayed) | |
| III | 80 | University of Gothenburg, Sweden | Between-subject factors:<br>- *veracity* (truthful vs. deceptive)<br>- *immediate interview* (*report everything* vs. *spatial questions*)<br><br>Within-subject factor:<br>- *time of interview* (immediate vs. delayed) | |
| IV | 96 | University of Portsmouth, United Kingdom | Between-subject factor:<br>- *instruction* (informed group vs. uninformed group) | *Veracity judgements*<br><br>*Self-reported cues to truth/deceit* |

Table 2.2

*Instructions for the mnemonic techniques used in the thesis.*

| Interview instruction | Study |
|---|---|
| *Report everything*:<br>'Report all details that you can remember about the break-in, including descriptions of objects and locations, the sequence of actions, and information about any people that were involved, including other witnesses or passers-by. Do not guess about details that you cannot remember'. | Study I, Study III |
| *CR*:<br>'I want you to take me back to the very start of that event, to the moment you entered the community centre. Take a few moments to picture in your mind where you were and what you saw at the time. Think about who you were with and what you could see during the event, including descriptions of objects and locations, and the sequence of actions. Give yourself plenty of time to concentrate and visualise what happened during that event. It may help to shut your eyes while you remember the event. Now tell me everything you remember'. | Study I |
| *Sketch*:<br>'I will ask you to make a sketch of the community centre you have broken into. Making a sketch of the scene may help you to remember details – and provide further information about the community centre. Please use as much space as you need to sketch it as you remember it. You should include as many details as possible, including as much information as you can about where different objects were in relation to other objects. You can use labels and notes within your sketch to indicate features of the scene, or to indicate whether you are not certain of something. This is not a test of your drawing ability – we are only interested in the layout of the apartment, that is, what you saw, and where. Sketch it in silence'.<br>*After the participant made the sketch, the following instruction was given:*<br>'I now want you to describe your sketch to me in so much detail that I would be able to make your sketch based on what you said. Thus, use words rather than just pointing at your sketch'. | Study I, Study II |
| *Event-line*:<br>'Now we are going to ask you to complete an "event-line". The purpose of the event-line is to help you organise your memory of the break-in. Importantly, it should help you put your account of the incident in the right order. This will be an initial account of the period of time you spent in the building, from the beginning until the end. You should use this opportunity to recall and report what activities you engaged in and when these took place along the event-line. Write down what happened in the empty space below the event-line and then put an arrow on the event-line indicating the time of the activity. Complete the event-line in silence'.<br>*After participants completed the event-line, the following instruction was given:*<br>'I want you to describe your event-line to me in so much detail that I would be able to make your event-line based on what you said'. | Study I |

## 2.2 Study I

### 2.2.1 Background

We aimed to investigate how different mnemonic techniques employed in the immediate interview affected truth tellers' and liars' responses immediately and after a two-week delay. The *CR*, *sketch*, and *event-line* mnemonic techniques were compared. Although previous research has examined the use of mnemonics to detect deception, none of the studies compared the effectiveness of specific mnemonic techniques in distinguishing truthful and deceptive responses. In addition, we sought to expand our knowledge of verbal deception detection when the interview is conducted after a delay. Specifically, we were interested in whether the *CR*, *sketch*, and *event-line* mnemonics used in the immediate interview helped differentiate truth tellers and liars after a two-week delay.

Our immediate interview included two parts, a free recall (FR) phase and a mnemonic phase. For statistical purposes, the analyses of the immediate and delayed reports compared the free recall phases of the immediate and delayed interviews (the delayed interview only included a free recall phase).

In all three mnemonic conditions, we expected that truth tellers would report more visual, spatial, temporal, and action details in the immediate FR. As a result of retrieval practice in the *CR* condition, it was expected that neither truth tellers nor liars would display a memory decline in the reporting of details after a delay, and that truth tellers would report even more visual, spatial, temporal, and action details than would liars after a delay in the *CR* mnemonic condition (*Hypothesis 1*). In the *sketch* mnemonic condition, we predicted that truth tellers would report more visual and spatial details than would liars after a delay as a result of practising these details in the sketch. We also expected that truth tellers, but not liars, would show a memory decline in temporal and action details after a delay, as these details would be less practiced in the *sketch* condition (*Hypothesis 2*). In the *event-line* mnemonic condition, it was predicted that truth tellers would report more temporal and action details than would liars after a delay as a result of practising these details in the event-line. Truth tellers, but not liars, would show a memory decline in visual and spatial details after a delay, as these details would be less practiced in the *event-line* condition (*Hypothesis 3*). Finally, in line with previous between-statement

consistency research, we predicted that truth tellers would produce more reminiscences and omissions than would liars between immediate and delayed interviews (*Hypothesis 4*).

### 2.2.2 Method

*Participants.* A total of 143 participants took part in the study. Their mean age was 25.57 years and 35.7% were male. In the sample, 80.4% were undergraduate and postgraduate students, and 18.6% were members of the general public. Participants were recruited via posters, flyers, an online participant pool system, and online advertisements at the University of Portsmouth's staff portals. As the experiment focused on the verbal content of the statements, native English speakers were prioritised to take part. Most participants (93.7%) were native English speakers; the remaining participants were fluent in English. Participants were awarded two course credits or GBP 10 for taking part in the study. In addition, all participants were entered into a draw to win a single prize worth GBP 150 on completion of the experiment.

*Design.* A 2 (Veracity: truthful vs. deceptive) × 3 (Mnemonic type: *CR* vs. *sketch* vs. *event-line*) × 2 (Time of interview: Immediate vs. delayed) experimental design was used with Veracity and Mnemonic as between-subject factors and Time of interview as the within-subject factor. Visual, spatial, temporal, and action details were the dependent variables for the type of detail analysis; reminiscences, repetitions, and omissions were the dependent variables for the consistency analysis. Participants were randomly assigned to be truth tellers ($n = 70$) or liars ($n = 73$). Truth tellers were randomly allocated to the *CR* ($n = 24$), *sketch* ($n = 23$), or *event-line* conditions ($n = 23$). Similarly, liars were randomly assigned to one of the three mnemonic conditions: *CR* ($n = 23$), *sketch* ($n = 26$), and *event-line* ($n = 24$). All participants were interviewed on two occasions, immediately after the stimulus event and (approximately) two weeks later. Not all participants were available to be interviewed again after exactly 14 days, so the delay period for the second interview varied between 8 and 21 days ($M = 14.10$); most participants (61.5%) were interviewed after 14 days.

*Stimulus event*. Participants were instructed to watch a video about a simulated break-in. They were instructed to imagine they were taking the role of an intelligence officer working undercover with another officer. They were told their task was to break into an apartment and secure some important intelligence information. This 'special task' was recorded from the perspective of the person (e.g., participant) who followed the other 'officer' throughout the

break-in. Participants were explicitly instructed that they were 'following their colleague' during the break-in.

The video event (lasting five minutes) shows a man entering a basement floor from the outside of the building. He then walks about ten metres through a corridor and tries to break through one of the doors at the end of the corridor. After a few attempts to open the door with a key, he walks into the room. The man in the video searches the room (containing, e.g., desks, shelves, cupboards, and clothes). He takes two mobile phones from a desk, jewellery (a necklace and two rings) from a cupboard, a laptop from a dining table, and a driving licence, debit card, EUR 35, and USD 20 in cash from a wallet in a jacket. He then leaves the room with these items. As the man walks back along the corridor on his way out, a neighbour opens a door, witnesses him leaving, and immediately closes the door. The man who broke in stops and briefly looks around by the building exit. Finally, he leaves.

*Procedure.* After watching the break-in, each participant was instructed either to tell the truth or to lie during the interview. Truth tellers and liars were given almost identical instructions. To minimise the risk of liars telling an embedded lie (e.g., by describing the apartment they genuinely lived in), all interviewees were told that the apartment they broke in to was the staff room of a community centre. Truth tellers were told that the break-in was successful and that they would be interviewed by a fellow agent to continue the intelligence investigation. They were asked to describe truthfully during the interview: 1) the interior of the staff room in the video and 2) what they took from there. Liars were also told that the break-in was successful. However, they were told that they would be interviewed by an agent from a hostile organisation and that their task was, therefore, to mislead that agent. They were told that if the hostile agent came to know where exactly they broke in and exactly what was taken from the apartment, the entire investigation would be in jeopardy. They were instructed to tell the hostile agent a cover story that they broke into a different staff room in a different community centre. Therefore, liars were instructed to lie about: 1) the interior of the apartment in the video and 2) what they took from there. To motivate all participants to do well in the interviews, they were told that they would receive two course credits or GBP 10, and would only be entered in the draw to win a prize worth GBP 150 if they were convincing during the interview. They were further told that if the interviewer thought that they did not report everything they remembered, they would receive only one course credit or GBP 5, would be excluded from the draw, and would be asked to write down a full account of what happened in the video.

After the instructions to tell the truth or lie, participants were given unlimited time to prepare for the interview. When participants indicated that they had prepared themselves, they were given a pre-interview questionnaire in which both truth tellers and liars were requested to answer the questions truthfully. In the questionnaire, participants were asked to rate on 7-point scales their preparation for the interview. They were asked to indicate: i) how well they were prepared (1 = *very poor*, 7 = *very good*) and ii) how sufficient (1 = *insufficient*, 7 = *sufficient*) and iii) how complete (1 = *incomplete*, 7 = *complete*) their preparation was. We clustered these three preparation items into one variable, *preparation quality*, since Cronbach's alpha (.86) indicated high consistency. The pre-interview questionnaire also included questions on how: iv) stressed (1 = *not at all*, 7 = *very stressed*); v) motivated (1 = *not at all*, 7 = *totally*), and vi) confident (1 = *not at all*, 7 = *totally*) the participants felt about being convincing in the upcoming interview. This pre-interview questionnaire was administered twice, before both the immediate and delayed interviews.

Next, participants were questioned by an interviewer who was blind to the aims of the study, stimulus material, and veracity conditions. At the beginning of the immediate interview, participants in all experimental conditions were given the same free recall (FR) instruction. They were asked to report everything they could remember from the break-in, including descriptions of objects and locations, the sequences of actions, and information about any people who were involved. After completion of this initial report, one of the three mnemonics (i.e., *CR*, *sketch*, or *event-line*) was administered. In the *CR* condition, participants were instructed to (mentally) go back to the very start of the break-in and visualise what happened during the break-in with their eyes shut. Then they were asked to tell everything they remembered. In the *sketch* condition, participants each made a drawing on an A3-sized blank sheet of paper. After they made a drawing, they were requested to describe it in as much detail as possible. In the *event-line* condition, participants were instructed to write on an A3-sized sheet of paper containing a graphical line (a grid divided into minutes) all actions from the event they could remember and to indicate on that line at what time these actions occurred. The grid was located at the top of the page and divided into six scale points (from 0 to 5 minutes). Participants were asked to write in the empty space and then put arrows on the event-line indicating the times of the specific activities. After completing the event-line, participants were instructed to describe the event-line in as much detail as possible.

After the immediate interview all participants were told that they would have to come back again in two weeks' time. At the beginning of this delayed interview, the same procedure was used as in the immediate interview (i.e., instructions to tell the truth/lie, preparation, and pre-interview questionnaire). Participants were given the FR instruction about the break-in.

Our aim was that the same interviewer would conduct both interviews to avoid the risk of an interviewer influencing an interviewee's accounts. However, some participants were interviewed by different interviewers due to time management issues (e.g., availability of participants, research assistants, or interviewers). Most participants (81.1%) were interviewed both times by the same interviewer and two interviewers conducted most of the interviews (72.0%). To ensure that interviewees followed identical instructions during the pre-interview and interview phases, written scripts were prepared that were to be used in every interview by the research assistants and interviewers.

After the delayed interview, participants were asked to fill out a post-interview questionnaire. As with the pre-interview questionnaire, truth tellers and liars were requested to respond truthfully. The post-interview questionnaire included questions to assess (again, on 7-point Likert scales) what the participants thought the likelihood was of receiving two credits or GBP 10 and having to write a statement (1 = *not at all*, 7 = *very likely*). In addition, as previous research has shown that active repetition of learned information can buffer against memory decline, we asked participants in an open-ended question how many times they had tried to remember the break-in (truth tellers)/cover story (liars) in the time between the two interviews. Lastly, we asked participants to assess the extent to which they i) told the truth and ii) lied during the interview. Answers were given on an 11-point Likert scale ranging from 0% (*not at all*) to 100% (*totally*). These two questions were asked twice to assess the truthfulness in both the immediate and delayed interviews.

After completing the questionnaire, participants were thanked and fully debriefed. All participants were paid GBP 10 or given two credits for participation. After completing data collection, one participant was randomly selected as the GBP 150 prize winner.

*Coding.* Interviews were transcribed verbatim. All statements were coded for the details provided by interviewees. Details were counted separately according to responses on: 1) free recall (FR); 2) one of three mnemonics in the immediate interviews; and 3) FR in the delayed

interviews. Each detail (or synonym referring to the same detail) was counted once per question response. Visual, spatial, temporal, and action details were coded.

Two coders carried out the coding. Both coders were trained by a senior member of the research lab. The first coder, the author of this thesis, marked all transcripts. The second coder, blind to the hypotheses, stimulus event, and veracity of the statements, marked a random sample of 29 interview scripts (20.28%) to measure reliability. Inter-rater reliabilities between the two coders for the frequency of detail in both immediate and delayed statements were measured via interclass correlation coefficients (ICC). The ICCs revealed excellent inter-rater values: .99 for visual details, .98 for spatial details, .92 for temporal details, and .97 for action details.

For between-statement consistency, we measured the responses between the immediate FR and delayed FR. The RM details coded previously were used for consistency analysis. We made a distinction between repetitions (i.e., details reported in both the immediate and delayed FRs), reminiscences (i.e., details reported in the delayed but not the immediate FR), and omissions (i.e., details reported in the immediate but not the delayed FR).

The coders marked reminiscences, whereas repetitions and omissions were determined using arithmetic calculations. We coded details as reminiscences in the delayed interview if they were not present in the FR of the immediate interview. Repetitions were computed by deducting reminiscences from the total number of details in the delayed interviews and omissions were calculated by deducting repetitions from the total number of details in the immediate FRs. The same two coders who marked the RM details were used for the consistency coding. The consistency training they received followed a similar format as the training they received for the RM details. Again, the first coder marked all transcripts and the second coder marked 20.28% of the randomly chosen interviews. We examined inter-rater reliability for reminiscences, and the analysis revealed sufficient ICC values of .71 for reminiscences in the delayed versus immediate FRs.

### 2.2.3 Results and discussion

*Manipulation checks.* Mixed-design analyses of variance (ANOVAs) with Interview as the within-subject factor and Veracity as the between-subject factor were used for the manipulation checks. For the answers to the pre- and post-interview questionnaires, liars expressed being more stressed than did truth tellers before the interviews ($p < .05$); truth tellers felt more confident

than did liars in their ability to convince the interviewers that they were telling the truth ($p$ < .001); both truth tellers and liars were highly motivated, indicated good level of preparation, and prepared themselves for similar amounts of time before the interviews ($p$'s > .05); liars thought more often about the event than truth tellers before the delayed interview, $p$ < .05; truth-tellers were more convinced than were liars that they would receive the full incentive of GBP 10/2 credits ($p$ < .001); and truth tellers were more truthful than were liars during both the immediate and delayed interviews ($p$'s < .001). These results showed that the manipulations in Study I were successful.

*Hypothesis testing.* Mixed ANOVAs with Veracity and Mnemonic type as the between-subject factors and Interview as the within-subject factor were carried out. The Veracity main effects were significant for all types of detail ($p$ < .001). The Mnemonic main effects were not significant for any of the types of detail ($p$'s > .05). The Interview main effects were significant for visual and action details ($p$'s < .01), indicating that interviewees reported more visual and action details in the immediate than delayed interview. The Interview main effects were not significant for spatial or temporal details ($p$'s > .05). The Veracity × Interview interaction effect was significant for temporal details ($p$ < .01), but not significant for visual, spatial, or action details ($p$'s > .05). The Veracity × Mnemonic type × Interview interaction effects were not significant for any of the types of detail ($p$'s > .05).

To test the hypotheses directly, simple effects analyses were conducted. Truth tellers reported more visual, spatial, temporal, and action details than did liars in the *CR* condition immediately and after a delay ($p$'s < .05). Truth tellers reported fewer temporal details in the delayed than the immediate interview ($p$ < .01). Truth tellers provided the same number of visual, spatial, and action details in the immediate and delayed interviews ($p$'s > .05). Liars in the *CR* condition did not any difference in the number of reported visual, spatial, temporal, or action details between the immediate and delayed interviews ($p$'s > .05). *Hypothesis 1* was partially supported. Truth tellers reported more visual, spatial, temporal, and action details than did liars in the *sketch* condition both immediately ($p$'s < .05), and after a delay, ($p$'s < .01). Truth tellers reported fewer temporal and action details in the delayed than in the immediate interview ($p$'s < .05). Truth tellers reported the same amounts of visual and spatial details in the immediate and delayed interviews ($p$'s > .05). Liars in the *sketch* condition reported fewer visual and action details in the delayed than the immediate interviews ($p$'s < .05).

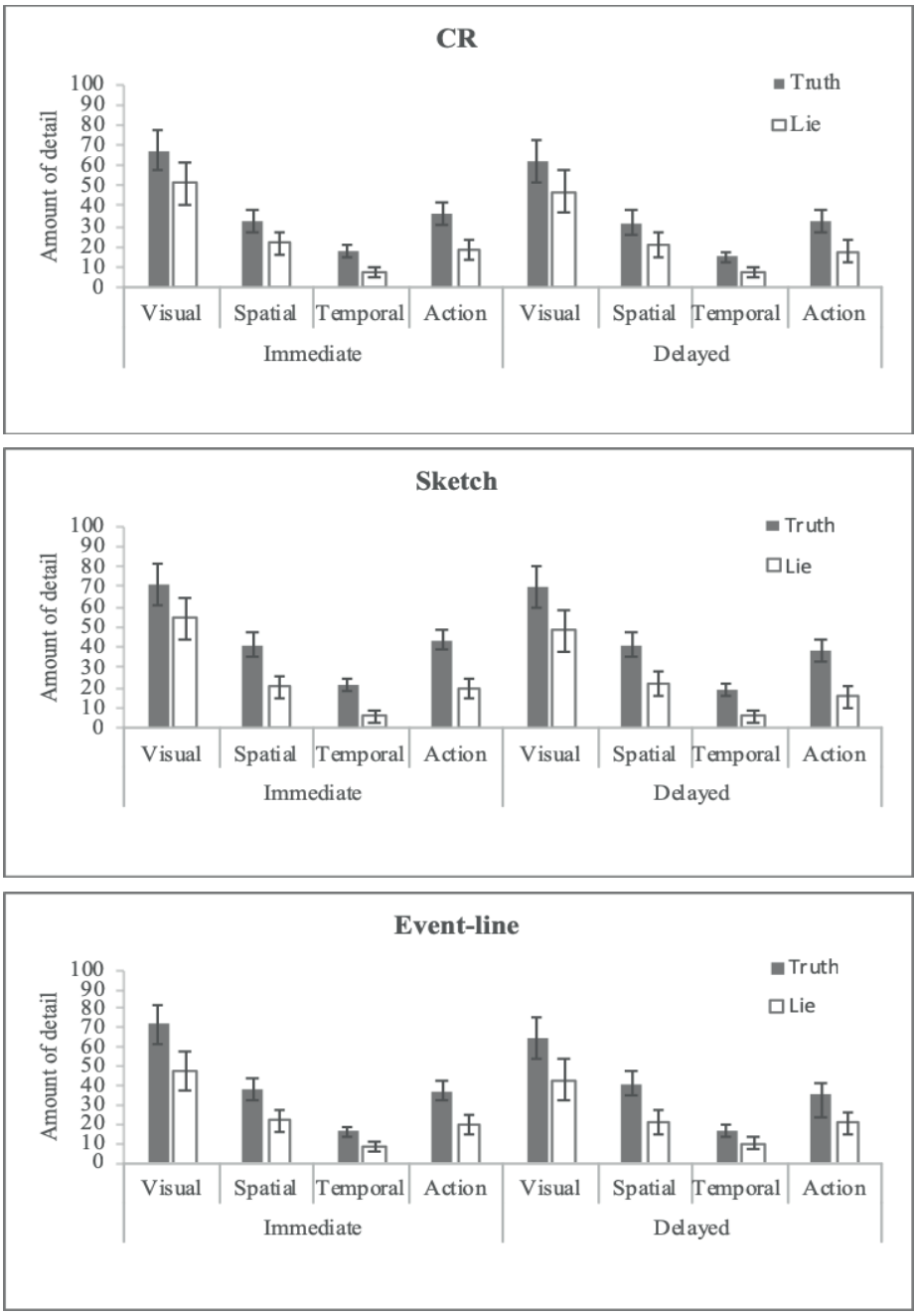


*Figure 2.1.* Amount of reported visual, spatial, temporal, and action details with 95% confidence intervals in the immediate and delayed FRs across conditions.

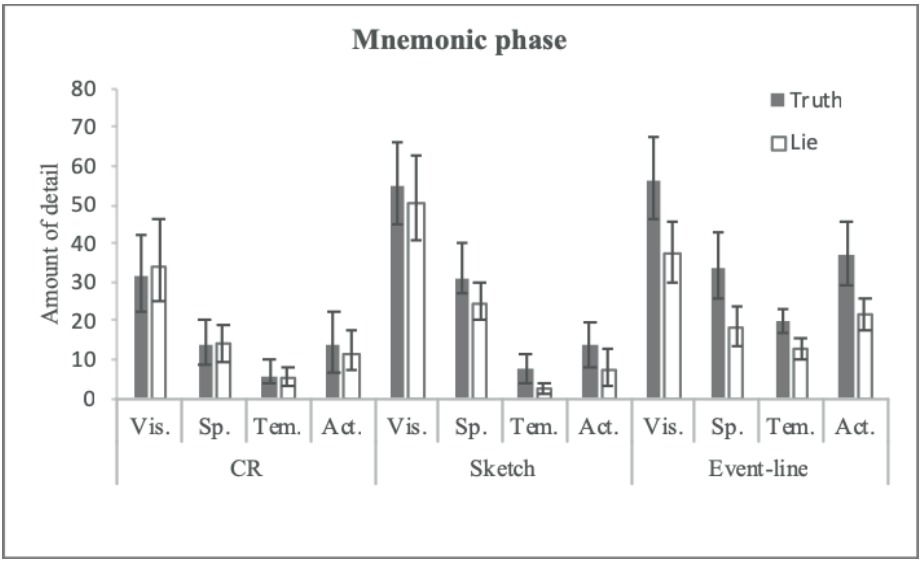


*Figure 2.2.* Amount of reported visual, spatial, temporal, and action details with 95% confidence intervals in the *CR*, *sketch*, and *event-line* descriptions in the immediate interview.

Liars showed no differences in the reporting of spatial or temporal details between the immediate and delayed interviews (*p's* > .05). These results partially supported *Hypothesis 2*. Truth tellers reported more visual, spatial, temporal, and action details than did liars in the *event-line* condition immediately and after a delay (*p's* < .01). In the *event-line* condition, truth tellers reported fewer visual details in the delayed interview than in the immediate interview ($p < .05$). Truth tellers showed no differences in the reporting of spatial, temporal, or action details between the immediate and delayed interviews (*p's* > .05). Liars displayed no differences in the reporting of visual, spatial, temporal, or action details between the immediate and delayed interviews (*p's* > .05). These results also partially supported *Hypothesis 3.* Figure 2.1 shows the number of details reported by truth tellers and liars in the immediate and delayed FRs across conditions.

The analyses of covariance (ANCOVA) with Total detail at immediate FR as a covariate were conducted for between-statement consistency comparisons between truth tellers and liars. The reason for including this covariate was that the numbers of reminiscences, repetitions, and omissions in the delayed interview were dependent on the amount of detail provided in the FR

part of the immediate interview. The results indicated that truth tellers and liars provided similar numbers of reminiscences, repetitions, and omissions in the *CR*, *sketch*, and *event-line* conditions (*p's* < .05). *Hypothesis 4* was not supported.

Although hypotheses related to participants' performance during the mnemonic part of the immediate interview were not specifically formulated, it was considered important to report the outcomes of this phase of the interview, as it gave further insight into how truth tellers and liars respond to mnemonics (see Figure 2.2). No significant differences were found between truth tellers and liars in the reporting of visual, spatial, temporal, or action details in the *CR* mnemonic condition (*p's* > .05). In the *sketch* mnemonic condition, truth tellers reported more spatial and temporal details than did liars (*p's* < .05). Other mean differences were not significant in this mnemonic group (*p's* > .05). In the *event-line* mnemonic condition, truth tellers reported more visual, spatial, temporal, and action details than did liars (*p's* < .05).

Taken together, the results of Study I indicated that when the *CR*, *sketch*, or *event-line* mnemonic techniques were used during the immediate interview, the verbal cue 'richness of detail' remained a diagnostic cue to deceit even after a delay. Truth tellers more often than liars showed a decline in detail reporting after a delay. Truth tellers and liars were equally consistent between the immediate and delayed statements.

## 2.3 Study II

### 2.3.1 Background

The findings of Study I indicated that using mnemonic techniques in an immediate interview after the event is a promising tool for differentiating truth tellers and liars in subsequent interviews. However, it was unclear whether the differences between truth tellers and liars in the delayed statements were affected by the immediate FR, the mnemonic technique, or both. Furthermore, observation suggested that the FR recall instruction given to the interviewees can also be considered a *report everything* mnemonic technique. That is, it asked participants to remember everything when reporting descriptions of objects, locations, actions, and people seen in the break-in. This instruction is in line with the definition of the *report everything* mnemonic technique offered in the literature (Fisher & Geiselman, 1992). Simply put, this mnemonic technique could buffer against the effects of the *CR*, *sketch*, and/or *event-line* mnemonics on the delayed accounts. Study II was an elaboration of Study I in order to directly test the effects of a mnemonic technique used in the immediate interview on the delayed statements of truth tellers

and liars. The effects of the *sketch* mnemonic condition were assessed in this study. We chose to examine the *sketch* condition because it can be easily administered by the interviewers in real-life forensic applications (Dando et al., 2009; Vrij et al., 2010). Also, this mnemonic technique has been positively evaluated by practitioners (Rivard et al., 2014).

The contents of truth tellers' and liars' descriptions of the sketch in immediate and delayed interviews were examined. We expected truth tellers to report more visual, spatial, temporal, and action details than would liars in the immediate accounts (*Hypothesis 1*). As truth tellers could sketch and report these details (i.e., have memory practice) in a sketch, we further predicted that truth tellers would report more visual and spatial details than would liars after a delay (*Hypothesis 2*). We expected truth tellers, but not liars, to show a memory decline for temporal and action details after a delay. Truth tellers would show a memory decline for such details because of a lack of practicing temporal and action details in *sketch* descriptions (*Hypothesis 3*). Regarding between-statement consistency characteristics, we predicted that truth tellers would be less consistent than would liars. Specifically, truth tellers would include the same number of repetitions, but more reminiscences and omissions than would liars in the delayed interviews (*Hypothesis 4*).

### 2.3.2 Method

*Participants*. A total of 49 university students took part in the study. Their mean age was 19.65 years and 79.6% were female. Participants were recruited via posters, flyers, the online participant pool system, and online advertisements at the University of Portsmouth's staff portals. Most participants (93.9%) were native English speakers and the remaining participants were fluent in English. Participants received the same reward as in Study 1 for taking part in this experiment.

*Design.* A 2 (Veracity: truthful vs. deceptive) × 2 (Time of interview: immediate vs. delayed) experimental design was used with Veracity as the between-subject factor and Time of interview as the within-subject factor. Visual, spatial, temporal, and action details were the dependent variables for the type of detail analysis; reminiscences, repetitions, and omissions were the dependent variables for the consistency analysis. Interviewees were randomly assigned to be truth tellers ($n = 25$) or liars ($n = 24$). As not all participants were available exactly 14 days after the first interview, the delay period for the second interview varied between 12 and 18 days ($M = 13.90$). Most participants (81.6%) were interviewed the second time after 14 days.

*Procedure.* Participants watched the same video and received identical instructions and pre- and post-interview questionnaires as in Study I. The only difference was that in the immediate and delayed interviews, participants were given the sole instruction to make a sketch, and to describe their sketch in as much detail as possible. One interviewer, blind to the aims of the study, stimulus material, and veracity conditions, conducted the interviews.

*Coding.* The same coding system was applied for types of detail and between-statement characteristics as in Study 1. Again, the author of this thesis coded all transcripts. A second coder, blind to the hypotheses, stimulus event, and veracity of the statements, coded a random sample of 12 interview scripts (24.5%) to measure reliability. The ICC revealed the following inter-rater values: .76 for visual details, .87 for spatial details, .63 for temporal details, and .83 for action details. As the ICC obtained for temporal details was moderate, the results for this type of detail should be interpreted with caution. The second coder also coded a random sample of 11 interview scripts (22%) to measure the reliability for reminiscences; the analysis revealed a high ICC of .87 for reminiscences in the delayed versus immediate *sketch* reports.

### 2.3.3 Results and discussion

*Manipulation checks.* Mixed ANOVAs with Time of interview as the within-subject factor and Veracity as the between-subject factor were used for the manipulation checks. Liars reported a higher level of stress than did the truth tellers ($p < .05$) Truth tellers felt more confident than did liars in their ability to convince the interviewer that they were telling the truth ($p < .05$). Truth tellers and liars were highly motivated, indicated a good level of preparation, and prepared themselves for similar amounts of time before the interviews ($p's > .05$). Liars thought more often about the event than did truth tellers ($p < .05$). Truth tellers were more truthful than were liars in the immediate and delayed interviews ($p's < .001$). The results of Study II indicated that the manipulations in this experiment were successful.

*Hypothesis testing.* Mixed ANOVAs were carried out with Time of Interview as the within-subject factor and Veracity as the between-subject factor. There was a significant main effect of Veracity for all types of detail ($p's < .05$). The Time of Interview main effects were not significant for any types of detail ($p's > .05$). The Veracity × Time of interview interaction

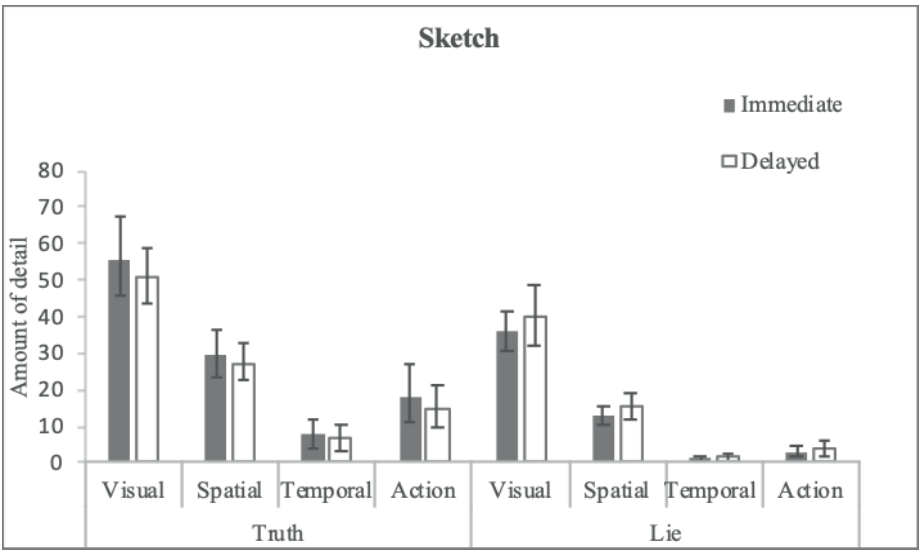


*Figure 2.3*. Total amount of different details with 95% confidence intervals in the immediate and delayed statements across veracity conditions.

effects were significant for spatial and action details (*p's* < .05), but not significant for visual or temporal details (*p's* > .05). To test the hypotheses directly, simple effects analyses were conducted. As expected, truth tellers reported more visual, spatial, temporal, and action details

than did liars in the immediate interview (*p's* < .01). *Hypothesis 1* was supported. Truth tellers reported more spatial, temporal, and action details than did liars in the delayed *sketch* descriptions (*p's* < .05). The number of reported visual details was not different between truth tellers and liars after a delay (*p* > .05). *Hypothesis 2* was partially supported. Truth tellers showed a significant decline in the reporting of action details (*p* < .05), but no difference in the reporting of visual, spatial, or temporal details emerged between immediate and delayed statements (*p's* > .05). There was no difference between liars' immediate and delayed statements in the amount of any type of detail reported (*p's* > .05). These results partially supported *Hypothesis 3*. The amounts of detail reported by truth tellers and liars in the immediate and delayed accounts are shown in Figure 2.3. Finally, the analysis of covariance with Total detail at immediate *sketch* as a covariate showed that truth tellers and liars reported a similar number of reminiscences and repetitions, and omitted a similar number of details in the delayed interview (*p's* > .05). Thus, *Hypothesis 4* was rejected.

This experiment provided additional evidence for the findings of Study I, showing that when the *sketch* mnemonic technique was used during the immediate interview, the verbal cue 'richness of detail' remained a diagnostic cue to deceit after a two-week delay (except for visual details). Truth tellers showed a decline in the reporting of action details after a delay, whereas liars did not show decrease in the reporting of information after a delay. Truth tellers and liars were equally consistent between the immediate and delayed statements.

## 2.4 Study III

### 2.4.1 Background

Although the results of Studies I and II indicated that mnemonic techniques used in the immediate interview can be helpful in differentiating truth tellers and liars after a delay, it cannot be said with certainty that the effect was caused by the use of mnemonics. It could also have been the result of mere retrieval practice, regardless of the quality of initial questioning. In Study III these factors were disentangled. The *report everything* mnemonic technique, eliciting more complete accounts, was compared with the *spatial questions*, eliciting less detailed statements. How these types of questioning used in the immediate interviews affected the delayed statements of truth tellers and liars was examined. I chose to investigate spatial open-ended questions because these can give valuable knowledge of the directions of movement, locations of people or objects, and layout of crime scenes (Hope et al., 2011). However, when the interviewer puts emphasis only on questioning about one aspect of the event (i.e., spatial information), but neglects to ask questions about the other aspects (e.g., descriptions of people's actions during the crime), there is a risk of eliciting less complete statements at the initial interview and after a delay (Gabbert et al., 2016). Deception detection can also be hindered as a result of less information reported by the truth tellers.

It was predicted that truth tellers would report more visual, spatial, temporal, and action details than would liars after a delay in the immediate *report everything* condition (*Hypothesis 1*). Compared with liars, truth tellers would report more visual and spatial details and an equal number of temporal and action details in the delayed statements of the *spatial questions* condition (*Hypothesis 2*). It was expected that differences between truth tellers and liars would be larger in the *report everything* condition than in the *spatial questions* condition in the delayed statements (*Hypothesis 3*). It was predicted truth tellers, but not liars, would show patterns indicative of genuine memory decay (*Hypothesis 4*). Finally, it was predicted that truth tellers

would produce more reminiscences and omissions than would liars after a delay in both the *report everything* and *spatial questions* initial reporting conditions (*Hypothesis 5*).

### 2.4.2 Method

*Participants.* A total of 81 volunteers took part in the study. The mean age of participants was 31.81 years and 72.8% were female. Participants were recruited via posters, flyers, and a volunteer database. Fluent English speakers were required for participation in the study because the verbal content of the statement was examined. Most participants were not native English speakers, so they were asked to rate their fluency in the English language before the beginning of the experiment.[1] One person was excluded because of language issues: the participant experienced difficulties in understanding the instructions and expressing him/herself during the interview. Thus, the final sample comprised 80 volunteers. They were rewarded with shopping vouchers worth SEK 100 (approximately EUR 10) after they completed the experiment. In addition, all participants were entered into a draw to win a single prize worth SEK 1000 (approximately EUR 100).

*Design.* A 2 (Veracity: Truthful vs. deceptive) × 2 (Immediate interview: *report everything* vs. *spatial questions*) × 2 (Time of interview: Immediate vs. delayed) experimental design was used with Veracity and Immediate interview as between-subject factors and Time of interview as the within-subject factor. Visual, spatial, temporal, and action details were the dependent variables for the type of detail analysis; reminiscences, repetitions, and omissions were the dependent variables for the consistency analysis. Participants were randomly assigned to the Veracity and Immediate interview conditions (*report everything*: truth tellers, $n = 18$ and liars, $n = 20$; *spatial questions*: truth tellers, $n = 22$ and liars, $n = 20$). All participants were interviewed twice, immediately after the stimulus event and two weeks later. Not all participants were available exactly 14 days after the first interview, so the delay time for the second interview varied between 8 and 27 days ($M = 14.66$). The delay time for most participants (45%) was 14 days.

[1] The English proficiency level scale was adapted from the London School of English (2018). The scale consisted of six categories: i) Elementary ('I can say and understand a few things in English'); ii) Pre-intermediate ('I can communicate simply and understand in familiar situations, but only with some difficulty'); iii) Intermediate ('I can speak and understand reasonably well and can use basic tenses, but have problems with more complex grammar and vocabulary'); iv) Upper-intermediate ('I speak and understand well, but still make mistakes and fail to make myself understood occasionally'); v) Advanced ('I speak and understand very well, but sometimes have problems with familiar situations and vocabulary'); and vi) Very advanced ('I speak and understand English completely fluently'). Participants classified themselves as Intermediate 6.3%, Upper-intermediate 25%, Advanced 37.5%, and Very advanced 31.3%.

*Procedure*. Participants watched the same video, received identical instructions and pre- and post-interview questionnaires as in Studies I and II. The only difference was the interviewing phase. In the immediate interview, participants were either provided with the *report everything* mnemonic technique or were given five open-ended questions related to spatial characteristics of the break-in, as follows: i) Describe the corridor of the apartment you broke into; ii) Describe the interior of the staff room; iii) Describe distinguishing features of the staff room; iv) Describe the outside area of the building you entered; and v) Describe what items were taken and where they were taken from. When participants returned for the second interview, interviewees in both conditions were given the *report everything* instruction. One interviewer, blind to the aims of the study, stimulus material, and veracity conditions, conducted the interviews.

*Coding.* The same coding system was applied for types of detail and between-statement characteristics as in Studies I and II. The author of this thesis coded all transcripts. The second coder, blind to the hypotheses, stimulus event, and veracity of the statements, coded a random sample of 16 interview scripts (20.0%) to measure reliability. The ICC revealed excellent inter-rater values: .95 for visual details, .96 for spatial details, .97 for temporal details, and .99 for action details. The second coder also coded a random sample of 15 interview scripts (18.8%) to measure reliability for reminiscences. The analysis revealed high ICC of .93 for reminiscences in the delayed versus immediate reports.

### 2.4.3 Results and discussion

*Manipulation checks.* Mixed ANOVAs with Time of Interview as the within-subject factor and Veracity as the between-subject factor were used for the manipulation checks. Truth tellers and liars were highly motivated, indicated a good level of preparation, and prepared themselves for similar amounts of time before the interviews (*p's* >.05.) Truth tellers were more truthful than were liars in the immediate and delayed interviews (*p's* < .001). Truth tellers and liars did not differ in terms of self-reported stress or confidence to convince the interviewer (*p's* >.05.)

*Hypothesis testing.* To examine whether the number of reported details differed between truthful and deceptive statements in the delayed interview, a multivariate analysis of variance (MANOVA) with Veracity and Immediate interview as the between-subject factors and visual, spatial, temporal, and action details as the dependent variables revealed a significant multivariate Veracity main effect ($p < .001$). Univariate Veracity main effects were significant for all types of detail (*p's* < .001). There was a significant multivariate Immediate interview main effect ($p <$

.001). At a univariate level, the Immediate interview main effects were significant for spatial, temporal, and action details ($p$'s < .01), but not significant for visual details ($p$ > .05). A multivariate Veracity × Initial interview interaction effect was not significant ($p$ > .05). At a univariate level, the interaction effects were significant for visual and action details ($p$'s < .05), but not significant for spatial or temporal details ($p$'s > .05). Simple effects analyses revealed that truth tellers reported significantly more visual, spatial, temporal, and action details than did liars in the *report everything* condition after the delay ($p$'s < .001). *Hypothesis 1* was supported. Truth tellers also reported significantly more visual, spatial, temporal, and action details than did liars in the *spatial questions* condition after the delay ($p$'s < .001). *Hypothesis 2* was partially supported because it was predicted that truth tellers would only report more visual and spatial details than would liars in the *spatial questions* condition after the delay. In the delayed reports, the differences between truth tellers and liars were more pronounced for visual and action details in the *report everything* than *spatial questions* condition (Figure 2.4). *Hypothesis 3* was partially supported.To test *Hypothesis 4* directly, only the statements in the *report everything* condition were analysed. The number of details in the *spatial questions* condition was not analysed because in this condition, different types of questions were used in the immediate and delayed interviews (i.e., *spatial questions* vs. *report everything*). Therefore, the reporting of differences between the

statements could emerge as a result of different types of questioning rather than as a direct result of delay. Simple effects analyses revealed that truth tellers showed a significant decline in the reporting of temporal details ($p$ < .01). Truth tellers showed no difference in the reporting of visual and spatial details. Liars showed no significant decline in the reporting of

visual, spatial, temporal, or action details ($p$'s > .05). Thus, *Hypothesis 4* was supported. To examine consistency between the immediate and delayed interviews of truth tellers and liars, an ANCOVA with Veracity and Immediate interview as the between-subject factors was conducted with reminiscences as the dependent variable and total detail at the immediate interview as a covariate. Truth tellers and liars reported a similar number of reminiscences in the *report everything* condition ($p$ > .05), but truth tellers reported more reminiscences than did liars in the *spatial questions* condition ($p$ < .001). Truth tellers reported more repetitions than did liars in both interview conditions ($p$'s < .05). Truth tellers also made fewer omissions than did liars in both interview conditions ($p$'s < .05). Between-statement consistency results thus partially supported *Hypothesis 5*.


*Figure 2.4.* Illustration of the veracity and type of interviewing interaction effects in the delayed interview.

Although the hypotheses focused only on the delayed accounts, it was also considered important to examine the effects of the two interview techniques on the immediate statements made by truth tellers and liars. A MANOVA with Veracity and Initial interview as the between-subject factors and visual, spatial, temporal, and action details as the dependent variables revealed a significant multivariate Veracity main effect ($p < .001$). Univariate Veracity main effects were significant for all types of detail ($p's < .001$). There was a significant multivariate Immediate interview effect ($p < .001$). At a univariate level, the Immediate interview main effects were significant for spatial, temporal, and action details ($p's < .001$). The univariate Initial interview main effect was not significant for visual details ($p > .05$). A multivariate Veracity × Initial interview interaction effect was also significant ($p < .001$). At a univariate level, the interaction effects were significant for all types of detail ($p's < .05$). These significant interaction effects showed that, in the immediate reports, the differences between truth tellers and liars were larger for visual, spatial, temporal, and action details in the *report everything* than *spatial questions* condition (Figure 2.5).

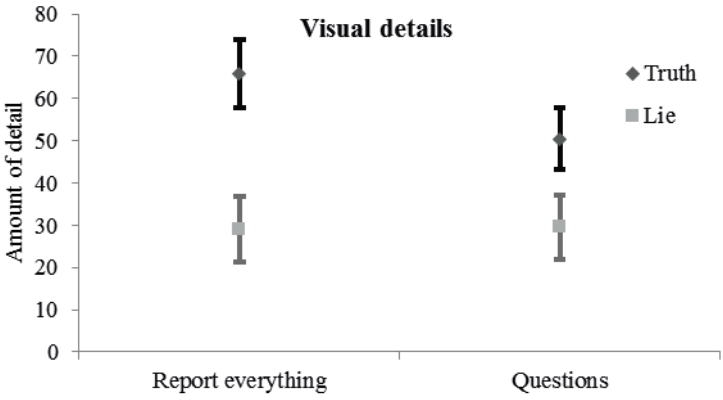


*Figure 2.5.* Illustration of the veracity and type of interviewing interaction effects in the immediate interview.

Taken together, the results of this study provided evidence that immediate interviewing eliciting more complete statements (i.e., the *report everything* mnemonic technique) was more helpful in distinguishing truth tellers and liars after a delay than was immediate interviewing eliciting less complete statements (i.e., *spatial questions*).

## 2.5 Study IV

### 2.5.1 Background

Actual differences in verbal content between truth tellers and liars do not ensure accurate veracity judgements. In this study, we were interested in the ability of observers to accurately identify the truth tellers and liars of Study I. Previous research has shown that accuracy in detecting deception improves when people rely on the correct verbal cues (Bogaard & Meijer, 2018; Hauch et al., 2016; Mann et al., 2004). I examined whether informing participants of Study I findings was related to their lie detection performance. We therefore informed one group of participants of these findings and asked the participants to take this into account when making their veracity judgements in the subsequent lie detection task.

It was predicted that the accuracy rates in identifying truth tellers and liars would be higher in the informed group than the uninformed group (*Hypothesis 1*). Accurately predicting participants were expected to rely more on the diagnostic verbal cues to deceit than were inaccurate participants (*Hypothesis 2*).

### 2.5.2 Method

*Participants.* A total of 92 volunteers participated in the study. The mean age of participants was 21.97 years and 82.6% were female. Participants were recruited via posters, flyers, and the University of Portsmouth's volunteer database. Fluent English speakers were required for participation in the study, because their task was to evaluate the verbal content of the statements. Participants were rewarded with GBP 5 after they completed the experiment.

*Design.* A 2 (Veracity: Truthful interviewee vs. deceptive interviewee) × 2 (Instruction: Informed group vs. Uninformed group) experimental design was used with Veracity and Instruction as the between-subject factors. Dependent variables were participants' veracity judgments and the answers given to questionnaire items about self-reported level of confidence and perceived cues that affected their decisions. Participants, who were randomly assigned to the Informed ($n$ = 46) and Uninformed ($n$ = 46) groups, were asked to read the statements of either truthful ($n$ = 23) or deceptive interviewees ($n$ = 23). The allocation to the Veracity condition also occurred randomly.

*Stimulus material.* Forty-six verbatim transcripts (23 truthful, 23 deceptive) obtained from Study I were used in the current experiment. We chose the transcripts of the 46 interviews using the *event-line* mnemonic, because in this mnemonic condition the effect sizes differentiating truth tellers and liars were larger than in the *CR* and *sketch* conditions.

*Procedure.* Each participant was randomly given one of the 46 set of transcripts. The participants were informed that they would now read two statements made by one person who might be lying or telling the truth about an incident, i.e., a break-in into an apartment. Participants were also notified that the first interview had been conducted immediately after the alleged event, and the second interview two weeks later.

Participants in the informed group were instructed: i) that the amount of detail (e.g., descriptions of people, objects, spatial arrangements, events, and activities) in the statement may be considered an indicator of truthfulness (that is, truth-tellers commonly report more details than do liars), and ii) that although the statements of truth tellers are usually richer, they tend to display a natural memory decline over time, whereas liars tend to report a similar amount of detail, no matter how much time has passed by since an event. Participants were instructed to take this into account when making their veracity judgments. The uninformed group was only

asked to read two interview transcripts from one interviewee and no instructions about the credibility cues were given.

After reading the two statements, all participants were asked to make a veracity judgment (i.e., whether the statements were provided by a truth teller or liar). They were also asked to what extent they thought the statements were truthful/deceptive (1 = *totally deceptive*, 7 = *totally truthful*) and how confident they were in their decision (1 = *not at all*, 7 = *totally*).

The informed participants only were also asked to rate: i) the extent to which their decision about the credibility of the statements was based on the amount of detail in the immediate and delayed statements (1 = *not at all*, 7 = *totally*), and ii) the extent to which their decision about the credibility of the statements was based on the difference in the amount of information provided in the immediate and delayed statements (for truth-tellers: decline in amount of detail; for liars: similar amount of detail) (1 = *not at all*, 7 = *totally*). These two items were used as manipulation checks. Finally, the informed participants were asked an open-ended question about what other factors influenced their credibility decision; the uninformed participants were asked the same open-ended question about what factors influenced their credibility decisions.

*Coding of perceived cues.* Participant's self-reported cues that affected their veracity decisions were classified into categories. The responses of the informed and uninformed groups regarding perceived cues were classified into categories. The terms for the categories were derived from previous deception research (DePaulo et al., 2003; Vredevelt et al., 2014; Vrij, 2008). One coder, blind to veracity condition, made the following classification of the reported cues: *richness of detail, lack of detail, change of details*, *contradictions*, *coherent order*, *incoherent order*, *consistency*, *omissions*, *reminiscences*, *plausibility*, *confidence*, *speech errors, hesitations*; responses that could not match any of the categories were coded as *other*. To measure inter-rater reliability, a second coder was given the list of categories and asked to allocate each response to a category. In total, 77.4% of the responses were classified into the same categories by both coders, indicating satisfactory inter-rater reliability. Discrepancies in coding were identified and resolved between the two coders.

Table 2.3
*Participants' (informed and uninformed groups combined) self-reported cues to truth/deceit and their reliability.*

| | **Decision: Truth** | **Decision: Lie** |
|---|---|---|
| **Perceived cue** | **Reliability of cue** | **Reliability of cue** |
| Richness of detail | *Reliable* | *Unreliable* |
| Plausibility | *Reliable* | *Unreliable* |
| Reminiscences | *Reliable* | *Unreliable* |
| Incoherent order | *Reliable* | *Unreliable* |
| Omissions | *Reliable* | *Unreliable* |
| Consistency | *Unreliable* | *Unreliable* |
| Speech errors, hesitations | *Unreliable* | *Unreliable* |
| Coherent order | *Unreliable* | *Unreliable* |
| Confidence | *Unreliable* | *Unreliable* |
| Lack of detail | *Unreliable* | *Reliable* |
| Change of details, contradictions | *Unreliable* | *Unreliable* |
| Other | *Unknown* | *Unknown* |

Based on meta-analyses and reviews of deception detection research (DePaulo et al., 2003; Vredevelt, van Koppen, & Granhag, 2014; Vrij, 2008), the perceived cues categories into reliable cues, unreliable cues, and unknown cues to truth/deceit were further classified (see Table 2.3). Note that some of the same cues were classified as either reliable or unreliable depending on the participants' veracity decisions. For example, the cue 'richness of detail' was classified as reliable if the decision made was truthful; however, this cue was treated as unreliable, if the decision made was deceptive, because a large amount of detail in a statement is considered an indication of truthfulness rather than deception (DePaulo et al., 2003; Vrij, 2008).

### 2.5.3 Results and discussion

*Manipulation checks.* When making veracity judgements, participants in the informed condition reported a tendency to rely on the amount of detail, and on the decline (for truth-tellers)/stability

(for liars) in number of details between the immediate and delayed interviews when making their veracity judgements (measured on 7-point Likert scales). These results indicate that participants in the informed group followed the instructions given to them about the verbal cues to deceit. Self-reported confidence levels about veracity judgements did not differ between the informed and uninformed groups ($p < .05$). Manipulations in this experiment were successful.

*Hypothesis testing.* To examine the accuracy rates of the informed and uniformed groups, chi-square tests were used. In the informed group, 56.5% of the statements were classified as truthful and 43.5% as deceptive ($p > .05$). In the uninformed group, 47.8% of the statements were judged as truthful and 52.2% as deceptive ($p > .05$). These results showed that none of the groups had a response bias.

In the informed group, 65.2% of truthful statements were correctly classified, compared with 47.8% in the uninformed group. However, these percentages did not differ significantly from each other ($p > .05$). The accuracy rate for deceptive statements was identical in the informed and uninformed groups, i.e., 52.2%. Overall, in the informed group, 58.7% of the statements were correctly classified, compared with 50.0% in the uninformed group. These rates did not differ significantly from each other ($p > .05$). Although the values were in the predicted direction, no support was found for *Hypothesis 1*.

There was a significant difference in frequencies of reported cues between the groups ($p < .01$). In the informed group, speech errors and hesitations were the cues reported most frequently, in 20.0% of statements (truth and lie decisions combined). In the uninformed group, consistency was the cue reported most frequently, in 26.6% of statements (truth and lie decisions combined). When the rates for both groups and veracity decisions were combined, consistency (in 21.0% of statements), speech errors and hesitations (16.9%), change of details and contradictions (14.5%), and richness of detail (14.5%) were the most prevalent reported cues. The majority in both groups reported unreliable cues ($p < .001$) (see Table 2.4).

Table 2.4

*Frequencies of the reliability of perceived cues in the informed and uninformed groups.*

| | **Informed group** | | **Uninformed group** | |
|---|---|---|---|---|
| **Perceived cues** | Frequency | % within perceived cues | Frequency | % within perceived cues |
| Reliable cues | 8 | 17.8 | 19 | 24.0 |
| Unreliable cues | 31 | 68.9 | 59 | 74.7 |
| Unknown cues | 6 | 13.3 | 1 | 1.3 |

The results of Study IV showed that informed participants were not more accurate than uninformed participants in their veracity judgements. This study also showed that even when observers are given information about reliable cues to deception, they still used unreliable cues when making veracity judgements.

# GENERAL DISCUSSION

## 3.1 Summary of the findings

The aim of this thesis was to examine how different mnemonic techniques used in an interview conducted immediately after an event affected truth tellers' and liars' responses in the immediate and delayed interviews. Tables 3.1 and 3.2 summarise the findings. These tables show the magnitude (i.e., effect sizes) of the differences between truth tellers and liars with respect to the amount of reported detail and consistency measures. The Cohen's *d* effect size tells us by how many standard deviations the means of the groups differed. According to the general guidelines, the sizes indicate small (0.2), medium (0.5), or large (0.8 and above) effects (Fritz, Morris, & Richler, 2012). Thus, the larger the effect size, the bigger the difference between truthful and deceptive responses obtained.

Table 3.1

*Summary of the Cohen's* d *effect sizes for the amount of reported detail using different mnemonic techniques. A positive* d *score indicates that truth tellers reported more details than did liars. Scores in bold refer to significant differences.*

| | Visual | Spatial | Temporal | Action |
|---|---|---|---|---|
| **Immediate interviews** | | | | |
| *Study I* | | | | |
| Context reinstatement (*CR*) | **0.52** | **0.83** | **1.56** | **1.60** |
| Sketch | **0.68** | **1.34** | **2.09** | **1.61** |
| Event-line | **1.13** | **1.23** | **1.08** | **1.47** |
| *Study II* | | | | |
| Sketch | **0.88** | **1.27** | **0.91** | **1.00** |
| *Study III* | | | | |
| Report everything | **1.48** | **1.37** | **2.05** | **2.01** |
| Spatial questions | **0.87** | **1.25** | **1.00** | **0.91** |
| **Delayed interviews** | | | | |
| *Study I* | | | | |
| *CR* | **0.58** | **0.74** | **1.21** | **1.19** |
| Sketch | **0.73** | **1.11** | **1.76** | **1.43** |

| | | | | |
|---|---|---|---|---|
| Event-line | **1.14** | **1.40** | **0.78** | **1.15** |
| *Study II* | | | | |
| Sketch | 0.51 | **0.93** | **0.75** | **0.91** |
| *Study III* | | | | |
| Report everything | **1.96** | **1.73** | **1.83** | **2.16** |
| Spatial questions | **1.30** | **1.49** | **1.90** | **2.06** |

With respect to the number of differences in visual, spatial, temporal, and action details reported by truth tellers versus liars, the effect sizes ranged from medium to large for the immediate (0.52–2.05) and delayed responses (0.58–2.16) across three studies in which participants were questioned using mnemonic techniques. The only veracity effect not found to be statistically significant was for the amount of visual detail in the delayed interview in Study II. In terms of consistency characteristics, significant effect sizes were obtained only in Study III. In sum, the findings suggest that truth tellers and liars differed substantially in the amount of information provided immediately and after a two-week delay.

Table 3.2

*Summary of the Cohen's* d *effect sizes for the consistency variables between statements. Positive scores indicate that truth tellers provided more details than did liars. Negative scores indicate that liars provided more details than did truth tellers. Scores in bold refer to significant differences.*

| | Reminiscence | Repetition | Omission |
|---|---|---|---|
| *Study I* | | | |
| *CR* | 0.14 | 0.12 | 0.12 |
| Sketch | 0.07 | 0.29 | 0.29 |
| Event-line | 0.09 | 0.14 | 0.14 |
| *Study II* | | | |
| Sketch | 0.54 | 0.09 | 0.09 |
| *Study III* | | | |
| Report everything | 0.48 | **1.22** | **-1.22** |
| Spatial questions | **1.48** | **0.78** | **-0.78** |

However, there were fewer differences between truth tellers and liars with respect to their consistency between the immediate and delayed statements. The interpretation of the findings will be elaborated on below.

### 3.2 Veracity and the immediate interviews

In Study I, truth tellers reported more visual, spatial, temporal, and action details than did liars when asked to report everything they remembered in the immediate interviews. As expected, these differences were found across all three mnemonic conditions. This finding is in line with previous research that has shown truth tellers to be more detailed than are liars when interviewed shortly after an event (Vrij, 2008, 2016). In Study I, both veracity groups were tasked with striving to be believed by the interviewer in order to get full compensation for participation. Furthermore, participants were told that they would be believed if the interviewer felt that they reported everything they remembered. However, even this instruction to report in as much detail as possible was insufficient for liars to provide as many details as truth tellers did in their immediate accounts. Liars could experience more difficulties than truth tellers in following the interviewer's instruction due to lack of imagination or information-management issues, because reporting too many fabricated details would give possible leads to the interviewer that they were lying (Granhag & Hartwig, 2008; Vrij et al., 2017b).

Examination of participants' responses divided according to mnemonic techniques showed that there was no difference in the amount of visual, spatial, temporal, and action detail between truth tellers and liars when the *CR* mnemonic was administered. In other words, using this mnemonic alone was ineffective in facilitating discrimination between truth tellers and liars. Comparison of the three mnemonic techniques showed that *CR* elicited less detail than did the *sketch* or *event-line* techniques (for truth tellers and liars combined). This suggests that truth tellers benefitted the least from the *CR* mnemonic. Liars could be less affected by the specific mnemonic technique administered due to the information-management strategies they typically employ (Hartwig et al., 2007). That is, liars might stick to their fabricated stories, regardless of the mnemonic (CR, *sketch*, or *event-line*) given to them. The *event-line* mnemonic elicited the largest differences between truth-tellers and liars. The stimulus event (break-in) shown to participants was dynamic; perhaps the *event-line* mnemonic facilitated the reporting of dynamic activities more than did *CR* or the request to sketch, which particularly benefitted truth tellers.

In Study II, which used only the *sketch* mnemonic, truth tellers provided more visual, spatial, temporal, and action details in the immediate interviews than did liars. Although this finding was predicted, it is worth discussing the difference between veracity groups regarding the amount of temporal and action detail. Specifically, in the *sketch* instruction, participants were asked to draw and then describe in as much detail as possible the layout and location of the objects in the place where the break-in happened. No instruction to provide temporal and/or action information was given to the interviewees. Nevertheless, truth tellers reported more temporal and action details than did liars when describing the sketch. It seems that truth tellers mentioned additional information not asked for in the instruction, whereas liars merely followed the instruction. Liars reported far fewer temporal and action details than visual and spatial details, which supports this interpretation of the findings. The reluctance to reveal additional details found in this study reflects the avoidance strategies typically used by liars (Hartwig et al., 2007).

When different immediate interviewing types were compared in Study III, truth tellers were found to provide more visual, spatial, temporal, and action details than did liars in both interviewing conditions. However, the difference between veracity groups was larger when the broader *report everything* instruction was used versus when the more specific spatial questions were asked. This finding suggests that instructions to report as many details as possible are more effective for lie detection purposes than asking more specific questions. This result is consistent with previous research comparing different questioning approaches (e.g., CI vs. standard questions) (Bembibre & Higueras, 2011; Hernández & Alonso-Quecuty, 1997), and is in line with the cognitive credibility assessment (CCA; Vrij, 2018) approach.

In summary, the experiments conducted in this study showed that truth tellers provided more detailed accounts than did liars when interviewed shortly after the event, but that the difference between truth tellers and liars was affected by the technique employed in the interview.

### 3.3 Veracity and the delayed interviews

In Study I, truthful statements contained more visual, spatial, temporal, and action details than did deceptive statements across all three mnemonic conditions in the delayed interviews. These results indicate that the credibility cue ‘amount of detail’ remained diagnostic even after a delay. Similar findings were obtained in a recent study in which participants were interviewed immediately and two weeks later (Nahari, 2018). However, in Study I larger differences than

expected were found between truth tellers and liars in the delayed interviews. Specifically, in the *sketch* condition, truth tellers produced more temporal and action details than did liars after the delay. We expected that there would be differences only in the number of visual and spatial details because of truth tellers' immediate recall practice of these details when making the sketch. In the same manner, in the *event-line* condition, we expected differences between truth tellers and liars after the delay in the number of temporal and action details only.

However, truth-tellers also reported more visual and spatial details than did liars in this condition after the delay. A possible explanation is that before the administration of each of the three mnemonic techniques, participants were asked in a free recall to describe what they had seen. Perhaps truth tellers could maintain good memories of visual, spatial, temporal, and action details after the delay because of the immediate practice of these details in the free recall. Memory research has found beneficial effects of initial testing on the subsequent recall of learned information (Pansky & Nemets, 2012; Roediger & Butler, 2011). The immediate reporting of visual, spatial, temporal, and action details could strengthen truth tellers' memory traces, enhancing access to these details after a delay.

To better understand the effects of mnemonics, the immediate and delayed interviews in Study II included the *sketch* instruction only. As in the immediate *sketch* descriptions, truth tellers provided more spatial, temporal, and action details than did liars after the delay. No difference was found in the number of visual details after the delay, and this was unpredicted. Two explanations for this unpredicted finding are possible. First, since the *sketch* instructions focuses on visual details, liars may have been particularly encouraged to provide such details. Second, liars might have thought it a 'safe' strategy to report visual details, because they do not give too many leads to investigators. For example, liars can provide visual details that are typically found in a staff room, for example, information about furniture, kitchen utensils, or electric devices. Accounts that include such information are less likely to contradict factual evidence. However, reporting too many spatial, temporal or action details might have put liars at risk of revealing self-incriminating evidence. For example, information about locations of objects, specific times and/or activities can be potentially checked by investigators (e.g. CCTV records or asking neighbours who could have witnessed the event in question). It is known that liars tend to avoid reporting self-incriminating evidence (Granhag & Hartwig, 2008).

In Study III, in both report everything and spatial questions conditions, the delayed truthful statements contained more visual, spatial, temporal, and action details than delayed deceptive statements. However, the differences between truth tellers and liars regarding visual and action details were larger when the *report everything* rather than the *spatial questions* mnemonic was employed in the immediate interview. These findings could be explained by examining liars' and truth tellers' responses in the immediate interview. Liars' responses were unaffected by the type of questioning in the immediate interview, but truth tellers provided less information (visual and temporal details, in particular) in the *spatial questions* condition than in the *report everything* condition. Thus, truth tellers who provided less detailed statements in the immediate interview also provided less detailed responses after the delay, resulting in less pronounced differences between truth tellers and liars after the delay. In summary, the results demonstrated that truthful accounts were more detailed than deceptive accounts after the delay, and that the extent of the differences between truth tellers and liars was influenced by the techniques used in the immediate interviews.

### 3.4 Comparison between immediate and delayed statements

In this thesis I was interested in learning how the amount of detail reported by truth tellers and liars changed between immediate and delayed interviews. Recent deception studies introduced the concept of 'stability bias', which refers to liars' difficulty understanding the nature of human memory, particularly the tendency to overestimate memory performance (Harvey et al., 2017a; Nahari, 2018). This suggests that the forgetting curve – i.e., the tendency to forget details over time – typical of truth tellers would be less pronounced or even absent in liars. In Study I, truth tellers in the *CR* condition reported fewer temporal details in the delayed than in the immediate interviews. In addition, in the *event-line* condition, truth tellers provided fewer visual details in the delayed than in the immediate interviews. Liars did not display a decline in the amount of any type of detail after the delay in these two mnemonic conditions. However, in the *sketch* condition, both truth tellers and liars showed a decline in information reporting. Truth tellers provided fewer temporal and action details and liars provided fewer visual and action details in the delayed versus the immediate interviews. In other words, when looking at the general reporting patterns of truth tellers and liars in each mnemonic condition, it became clear that both veracity groups showed a decline in the reporting of details in the delayed versus immediate interviews. Therefore, based on the findings of Study I, it cannot be concluded that only truth tellers showed a decline in the reporting of information after the delay.

Studies II and III obtained more evidence for the predictions regarding how truth tellers and liars report information over time. In Study II, truth tellers provided fewer action details in the delayed than immediate *sketch* descriptions, whereas liars did not show such a decline in any type of detail. In addition, truth tellers and liars displayed slightly different tendencies in the reporting of information between immediate and delayed interviews. There was a non-significant decline in the number of visual, spatial, and temporal details in truthful responses after a delay, but a non-significant increase in the number of visual, spatial, temporal, and action details reported by liars after a delay. In Study III, truth tellers reported fewer temporal and action details in the delayed than immediate interviews, whereas liars did not show such a decline in the amount of any type of reported detail. In addition, truth tellers showed a non-significant decline in the reporting of visual and spatial details after a delay, whereas liars displayed a non-significant increase in the reporting of visual, spatial, temporal, and action details after a delay.

The reasons for the different findings in Study I, on one hand, and Studies II and III, on the other, can only be speculated about. Observation of the mean values of visual, spatial, temporal, and action details reported by liars in the immediate interview suggests that in Study I the scores were considerably higher than in Studies II and III. Therefore, in Study I, liars could more easily afford to report fewer details in the delayed statements without thinking it would make them appear suspicious than could liars in Studies II and III. Studies show that liars believe that reporting a sufficient amount of detail is important for them to be believed (Hartwig et al., 2007; Nahari et al., 2014). Moreover, liars could also experience forgetting (Nahari, 2018), and this is more likely to happen when a lot of details were given initially. Nevertheless, this interpretation should be considered with caution and requires further examination. Overall, the findings of this thesis indicated that, in terms of the amount of detail provided over time, truth tellers more often than liars showed a decrease in the reporting of information after a delay. Truth tellers could well be affected by a time delay more than liars. If truth tellers relied on their memories and this resulted in less information remembered after two weeks, liars could be primarily preoccupied with providing convincing stories, regardless of the time interval between the event and the interview. To be convincing, the fabricated story needs to contain a sufficient amount of detail.

### 3.5 Consistency between immediate and delayed statements

In Studies I and II, truth tellers and liars provided a similar number of reminiscences, repetitions, and omissions when the immediate and delayed statements were compared, indicating that both

veracity groups were equally consistent between their accounts. These results are in line with the literature (Granhag et al., 2016; Granhag & Strömwall, 2002; Vredeveldt et al., 2014). Perhaps it was not a difficult task for liars to be as consistent as truth tellers because in both studies the immediate and delayed interviews contained the same instructions. Inconsistencies can emerge if the interview format changes, but may be less likely when it is held constant (Deeb et al., 2017; Leins et al., 2012). Furthermore, responses in the post-interview questionnaire revealed that, in both studies, liars thought more often about their fabricated story than truth tellers thought about the actual event between the immediate and delayed interviews. This suggests that liars were employing a 'repeat' strategy more often than were truth tellers, which could facilitate consistency.

Similar to Studies I and II, the results of Study III revealed that truth tellers and liars reported a similar number of reminiscences between the two interviews in the *report everything* condition. However, truth tellers mentioned more reminiscent details than did liars in the *spatial questions* condition. Perhaps truth tellers had the opportunity to provide additional details in the delayed interview because they were instructed to report all they could remember in that interview. Thus, details that were not mentioned in the immediate interview when spatial questions were asked were reported in the delayed interview. However, given liars' strategy of keeping it simple and repeating what they said before (Granhag & Hartwig, 2008; Granhag & Strömwall, 1999), they could not report too much additional information in the delayed interview. Additionally, in Study III truth tellers provided more repetitions and omitted fewer details than did liars in the delayed interview in both questioning conditions. These outcomes suggest that liars used a 'keep the story simple' strategy (Strömwall, Hartwig, & Granhag, 2006), because omitting details after a delay might prevent liars from contradicting themselves (Granhag & Strömwall, 1999). Overall, the findings of these studies suggest that truth tellers were as consistent as liars between the immediate and delayed accounts, which is consistent with previous research (Vredeveldt et al., 2014).

Some of the consistency findings may seem to contradict the observations made earlier in this thesis, and thus deserve further comment. Specifically, it was concluded that truth tellers, but not liars, showed a decline in the reporting of details between the immediate and delayed interviews. However, in this section we reported that in Study III liars omitted more details than did truth tellers, and that truth tellers produced more repetitions than did liars. This suggests that liars showed a larger decline in the reporting of details than did truth tellers. The reason for these

seemingly conflicting results is the different statistical methods used for the analyses of the amount of detail and consistency variables. Therefore, these two analyses should be interpreted independently of each other. In the amount of detail analysis, the actual numbers of reported visual, spatial, temporal, and action details were compared. When the between-statement consistency characteristics were assessed, the total amount of detail in the immediate interview was used as a covariate. It is reasonable to assume that without entering the covariate, truth tellers would produce more reminiscences, repetitions, or omissions than would liars, but that this would be the result of truth tellers' initial statements being richer in detail rather than the result of a difference in consistency between truth tellers and liars. This possibility was tested, which confirmed that in Studies I–III, truth tellers showed the tendency to produce more (in)consistency characteristics than did liars (see Appendix).

### 3.6 Observers' accuracy of veracity judgements

Whether the actual differences between truth tellers and liars with respect to amount of detail reported could be accurately detected by observers was also of interest in this thesis. In Study IV, participants either did or did not receive an instruction about the findings of Study I. Participants in the informed condition should have considered these findings when making veracity judgements. Nevertheless, it was found that the informed and uninformed participants did not differ in the accuracy of their veracity judgements.

Although participants in the informed group indicated that they relied on the information provided in the instructions, their accuracy was not higher than that of participants in the uninformed group. This can be explained by the self-reported responses, which showed that the majority of informed and uniformed participants relied on unreliable cues when making their judgements, such as 'speech errors', 'hesitations', and 'consistency'. This finding is consistent with previous research showing that laypeople and practitioners tend to hold incorrect beliefs about deception (Global Deception Research Team, 2006; Strömwall, Granhag, & Hartwig, 2004; Vrij, 2008). The results for the informed group support that such views are difficult to change. Different explanations have been proposed about the origin of the incorrect beliefs about deception. For example, the moral explanation refers to the stereotypical view that lying is bad (Vrij, 2008). If lying is bad, then people should feel ashamed and/or nervous about it and therefore display signs of nervousness (e.g., commit speech errors) (DePaulo et al., 2003). The current study showed that signs related to nervousness (e.g., speech errors and hesitations) were amongst the most prevalent cues mentioned by participants. In addition, the exposure

explanation suggests that stereotypical behaviours associated with deception are prominent in the popular media (Vrij & Granhag, 2007). For example, the popular crime drama TV series 'Lie to Me' depicted the main character as a security officer highly skilful in detecting deception. However, many of the interviewing tactics and 'signs of deception' shown in such series are not consistent with scientific evidence (DePaulo et al., 2003; Hartwig & Bond, 2011; Vrij & Granhag, 2012).

A possible explanation for the poor accuracy rates achieved here is that the instruction given to the informed group was not effective at prompting improvements in veracity judgements. Previous studies that did achieve enhanced lie detection accuracy involved at least a few hours of training, including theoretical information about reliable and unreliable cues to deception, practical examples, exercises, and feedback on trainees' performance (Hauch et al., 2016; Luke et al., 2016; Vrij, Leal, Mann, Vernham, & Brankaert, 2015), training lasting considerably longer than the brief instruction participants in Study IV received.

The reliability of the reported cues was also not related to the accuracy of judgements. That is, participants who reported reliable cues were as inaccurate as were participants who reported unreliable cues. This result could perhaps be best explained by the finding that the number of reliable cues reported by observers was very low in general. In conclusion, the results of Study IV indicated that even when observers were given information about reliable cues to deception, they still used unreliable cues when making veracity judgements, which negatively affected their veracity judgements.

### 3.7 Empirical and practical contributions

The research conducted for this thesis advances our knowledge of deception in three ways. First, the results replicated previous findings that truthful statements contain more details than do deceptive statements when participants are interviewed immediately after an event (Amado et al., 2016; DePaulo et al., 2003; Vrij, 2008). The current research has also provided evidence that truth tellers are able to report more details than are liars after a two-week delay. Not many studies have examined the credibility cue 'amount of detail' after the passage of time, when an immediate interview was also conducted (Granhag & Strömwall, 2002; Granhag, Strömwall, & Jonsson, 2003; Nahari, 2018). Furthermore, no deception studies have addressed the differences between truth tellers and liars in delayed interviews, after using mnemonic techniques in the immediate interviews. Second, in the current research, truth tellers and liars displayed somewhat

different patterns of information reporting over time. The tendency of truth tellers to provide more details in the immediate than the delayed interviews resembled memory decay (Ebbinghaus, 1885/1913). However, liars had a weaker tendency to display such a decline in the reporting of information, a phenomenon termed 'stability bias' in the deception literature (Harvey et al., 2017a). Third, our findings indicate that truth tellers were as consistent as liars between their statements (Vredeveldt et al., 2014). This is an important finding and confirms that unless specific techniques (e.g., SUE; Granhag & Hartwig, 2015) designed to induce inconsistencies in liars are used in interviews, (in)consistency should be considered an unreliable cue for detecting deception.

In terms of practical relevance, the current findings suggest that the way someone is initially interviewed has an effect on credibility assessments in subsequent interviews. Previous studies have demonstrated the benefits of high-quality immediate interviewing in terms of interviewees' memory performance (Gabbert et al., 2009; Hope et al., 2014), but the benefits may also extend to credibility assessments as well. The present findings might be relevant in different interviewing settings. For example, it might be useful for frontline officers or emergency call handling officers to obtain high-quality and complete accounts from witnesses or victims for possible repeated interviewing at the later stages of investigations. The same principle could also be applied when interviewing suspects, who especially tend to be interviewed more than once during the course of criminal investigations (Kassin et al., 2007), or within intelligence settings, for example, when interviewing informants.

The effect sizes of the differences between truth tellers and liars indicated that the *report everything*, *sketch*, and *event-line* mnemonic techniques had fairly large effects, pointing to effective detection of deception. Thus, it is recommended that for credibility assessment purposes, all interviewees should be invited to recall in as much detail as possible all they remember. Mnemonic techniques such as *sketch* and *event-line* should also be incorporated into interviewing settings for verbal lie detection. It can be argued that using techniques developed to enhance truth tellers' reporting of information can also, to some extent, increase the amount of information in liars' statements and may complicate deception detection. The more details liars provide, the more credible they may appear. Indeed, the absence of a specific threshold (i.e., cut-off score) in the amount of detail indicating when the interviewees are lying versus and when telling the truth does not allow to make straightforward correct veracity judgements (Vrij,

2016). However, elicitation of more details from both truth tellers and liars allows the investigator to check these details, and to compare them with any new evidence that appears.

Finally, briefly providing information about deception cues proved to be ineffective in improving observers' accuracy in making veracity judgements. Although the veracity judgements were made by lay participants in Study IV, the findings of this study could give insight into how to develop or improve training programmes on interviewing/deception detection for legal professionals. For example, training could involve not only informing trainees about reliable cues, but also informing them about unreliable cues. Such training also could include information about the reasons why some cues are reliable and others unreliable.

### 3.8 Methodological considerations and limitations

The main aim of this thesis was to examine how different mnemonics employed in an immediate interview affect the reporting of specific types of detail in both immediate and delayed interviews. As a result of this aim, Studies I–III did not contain standard control groups in which participants would be provided with instructions eliciting less complete accounts. The absence of control conditions made it impossible to conclude whether the use of mnemonic techniques in the immediate interviews as such influenced the interviewees' responses. This approach to the design of the studies can be considered a limitation in that it confines us to concluding that these effects would not have been achieved without the use of mnemonics in the immediate interview. However, it is reasonable to assume that the mnemonics used in the initial interviews were helpful in detecting deception in the delayed interviews for two reasons. First, research has shown that liars tend to display a stability bias (Harvey et al., 2017a; Nahari, 2018; Vrij et al., 2009), whereas truth tellers' memory of an event becomes weaker over time, resulting in their reporting fewer details over time (Ebbinghaus, 1885/1913; Lawson & London, 2015; Tuckey & Brewer, 2003). The combined effect is that the difference between truth tellers and liars in the reporting of details becomes less pronounced over time. We assume that in the absence of immediate interviewing, the two-week delay employed in our experiments was long enough for truth tellers to show a substantial decrease in recalled information. However, in all three experiments, truth tellers' decline in the reporting of details was rather small, with the result that truth tellers reported more details than did liars even after a delay. The results further indicated that most of the details truth tellers reported in the delayed interviews were repetitions of what they said in the immediate interviews. This suggests that truth tellers had relatively good memories of their initial responses. Second, a comparison between two types of immediate

questioning in Study III showed that the *report everything* mnemonic was more effective (although modestly so) than was asking spatial questions to discriminate between truth tellers and liars after the delay. Given the magnitude of the effect sizes, it can be argued that in the *spatial questions* condition, the differences between truth tellers and liars in the delayed interviews were also large. Indeed, the way these questions were formulated (e.g., 'describe the interior of the staff room') suggests that they were in line with investigative interviewing guidelines, and that after asking such questions, relatively complete answers could be expected (Oxburgh, Myklebust, & Grant, 2010). Nevertheless, no reason can be identified as to why the quality of the immediate interview (e.g., eliciting short answers from the interviewees) would not affect deception detection after the delay.

A staged video event was used as the stimulus material across the three experiments. Participants were instructed to passively watch the staged event and to imagine their active involvement in the break-in. The benefit of such a controlled setting is that all participants witnessed exactly the same event, ruling out differences in exposure between participants or conditions. However, it is unknown whether real participation in the break-in would have resulted in different outcomes in the three experiments. It may have affected the amount of detail reported in an undefined manner: It could have resulted in more details being reported because participants paid more attention to the event, or fewer details being reported due to distractions.

Another aspect of ecological validity is that most participants across the studies comprised students or members of the general public rather than legal professionals. Samples with more representative participants (e.g., intelligence officers with greater insight into covert operations than that of laypeople) would have brought more value into the findings. It is unknown how knowledge and/or experience of the subject matter would affect deceptive responses. Again, the amount of detail reported might be affected in an undefined direction: liars could provide convincing accounts with many details, or, in contrast, be more careful and report fewer details to avoid the risk of incriminating themselves.

Finally, measuring the difference between truth tellers and liars in the reporting of visual, spatial, temporal, and action details is not entirely useful in real-life investigations. Specifically, these types of details as such do not yield that much valuable information for criminal investigations. In the current thesis, these types of detail were examined because this was a first step towards understanding the effects of mnemonic techniques, used in the immediate interviews, on

deception detection in delayed interviews. Thus, I primarily focused on the quantity of details in the statements reported by truth tellers and liars.

### 3.9 Future directions

The research conducted for the current thesis provides a basis for future research to examine, in greater detail, the mnemonic techniques used to detect deception in repeated interviews. This line of research could be further extended in several areas.

Future studies could focus on different interviewing situations, such as the time span between the critical event and questioning, as well as the number of interviews. Specifically, further deception studies could examine the effects of mnemonic techniques on repeated statements: i) when the first interview takes place after an extended period of time, that is, longer than that used in the current studies; and ii) when someone is interviewed on more than two occasions. These two scenarios are common in real-life criminal investigations. They are worthy of examination because the negative effect of time delay (without retrieval practice) on memory and verbal deception detection is known (Ebbinghaus, 1885/1913; Harvey et al., 2017a; Roediger & Butler, 2011). On the other hand, the positive effects of mnemonic techniques to enhance reporting of information after a delay have been identified (Dornburg & McDaniel, 2006; Larsson, Granhag, & Spjut, 2003; Rivard et al., 2014).

Furthermore, the use of mnemonic techniques in repeated interviews could be examined in high-stakes situations. For liars, the consequences of being caught in criminal cases are typically serious. The need for applied research (e.g., in police settings) has previously been advocated by scholars in legal psychology (Oxburgh, Walsh, & Milne, 2011; Porter & ten Brinke, 2010). It is reasonable to expect that increasing ecological validity would encourage stakeholders to apply evidence-based findings in legal settings (Blair & Kooi, 2004). Furthermore, examining such situations could be beneficial. Specifically, some studies have shown that police officers are considerably more accurate when detecting high-stakes deception (Wright & Wheatcroft, 2017; Wright Whelan, Wagstaff, & Wheatcroft, 2015). Though the development of experimental set-ups may be complicated due to ethical considerations, future laboratory studies could raise the stakes while remaining within ethical boundaries. A solution to these issues could be to increase participant rewards from modest (i.e., a prize worth a cinema ticket) to more solid compensation for participants trying their best to convince the interviewer.

Additionally, completion of a field study could be an important further step in verbal lie detection. This could involve, for example, real (i.e., recorded and/or transcribed) repeated interviews with suspects in which the investigator(s) use different information-gathering approaches, including the mnemonic techniques studied here. These interviews would meet the stringent criteria for establishing ground truth in order to compare truth tellers and liars. Such research would demand a thesis of its own, yet could greatly contribute to the scientific literature on verbal lie detection.

The effectiveness of deception detection may depend on the conditions in which an event was encoded in memory (Harvey et al., 2017b). In everyday situations, it is common for the encoding quality of the event experienced to be impeded, for example, as a result of incidental focus on specific details (Carlson, Dias, Weatherford, & Carlson, 2016), intoxication (Hagsand, Roos af Hjelmsäter, Granhag, Fahlke, & Söderpalm-Gordh, 2013), or poor viewing conditions (Wells & Olson, 2003). The role of mnemonic techniques in distinguishing truth tellers and liars when encoding conditions are complicated is currently unknown.

In light of recent atrocities related to extremist organizations around the globe, deception researchers have also begun to address the issue of false intentions (Granhag & Mac Giolla, 2014; Sooniste, Granhag, & Strömwall, 2017; Vrij, Granhag, Mann, & Leal, 2011). In a recent study, CI showed benefits in terms of detecting false intentions (Sooniste, Granhag, Strömwall, & Vrij, 2015). The present research could be extended to examine the effects of mnemonic techniques on repeated accounts over the passage of time when a critical event is planned, for example, few months in advance.

Finally, future studies using mnemonic techniques could examine qualities of detail that have more forensic relevance, such as verifiable details (Nahari et al., 2014) or salient details (Deeb et al., 2018; Sakrisvold, Granhag, & Mac Giolla, 2017), and their consistency between interviews. Examination of the quality of details may be important when the extent of lying in deceptive stories is low. Studies conducted in the current thesis considered the self-reported extent of liars' truthfulness in the interviews (as asked in the post-interview questionnaires). However, most liars' stories (approximately 70–80%) contained fabrications. Future deception studies focusing on the effects of mnemonic techniques could develop more challenging scenarios in which liars would falsify only a minimal amount of information.

### 3.10 Conclusions

The research presented here shows that when mnemonics were used during the immediate interview, the verbal cue richness of detail remained a diagnostic cue to deceit even after a delay. In addition, truth tellers more often than liars showed a decline in the reporting of details after a delay. Truth tellers showed patterns of reporting indicative of genuine memory decay, whereas liars showed patterns of 'stability bias', i.e., a failure to accurately estimate memory decay (Harvey et al., 2017a). Also, this research replicated previous research demonstrating that truth tellers and liars are equally consistent when interviewed twice (Vredeveldt et al., 2014). Finally, it was found that lay observers showed poor accuracy in detecting truths and lies, and a strong reliance on incorrect stereotypical cues when making these judgements.

Overall, the findings indicate that mnemonic techniques such as *report everything*, *sketch*, or *event-line* in a first interview conducted shortly after the event show promise to aid deception detection in immediate and delayed interviews. This thesis contributed to our understanding of verbal deception detection in a repeated interviewing context.

## References


Achieving Best Evidence in Criminal Proceedings (2011). *Guidance on interviewing victims and witnesses, and guidance on using special measures.* Retrieved from https://www.cps.gov.uk/sites/default/files/documents/legal_guidance/best_evidence_in_criminal_proceedings.pdf

Amado, B. G., Arce, R., Farina, F., & Vilariño, M. (2016). Criteria-Based Content Analysis (CBCA) reality criteria in adults: A meta-analytic review. *International Journal of Clinical and Health Psychology, 16*, 201-210. DOI: 10.1016/j.ijchp.2016.01.002

Anderson, J. R. (1983). A spreading activation theory of memory. *Journal of Verbal Learning and Verbal Behavior, 22*, 261–295. DOI:10.1016/S0022-5371(83)90201-3

Baddeley, A., D., Eysenck, M., W., Anderson, M., & Anderson, M. C. (2009). *Memory.* Psychology Press.

Baumeister, R. F. (1998). The self. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology* (4th ed. pp. 680–740). Boston, MA: McGraw-Hill.

Bembibre, J., & Higueras, L. (2011). Differential effectiveness of the cognitive interview in a simulation of testimony. *Psychology, Crime & Law, 17*, 473–489. DOI: 10.1080/10683160903321540

Blair, J. P., & Kooi, B. (2004). The gap between training and research in the detection of deception. *International Journal of Police Science and Management, 6*, 77-83. DOI: 10.1350/ijps.6.2.77.34465

Bogaard, G., & Meijer, E. H. (2018) Self-reported beliefs about verbal cues correlate with deception-detection performance. *Applied Cognitive Psychology, 32*, 129–137. DOI: 10.1002/acp.3378.

Bogaard, G., Meijer, E., Vrij, A., & Merckelbach, H. (2016). Scientific content analysis (SCAN) cannot distinguish between truthful and fabricated accounts of negative events. *Frontiers in Psychology, 7,* 243. DOI: 10.3389/fpsyg.2016.00243

Bok, S. (1978). *Lying: Moral choice in public and private life*. New York: Random House.

Bond, C. F., & DePaulo, B. M. (2006). Accuracy of deception judgements. *Personality and Social Psychology Review, 10*, 214–234. DOI: 10.1207/s15327957pspr1003_2

Bornstein, B. H., Liebel, L. M. & Scarberry, N. C. (1998). Repeated testing in eyewitness memory: A means to improve recall of a negative emotional event. *Applied Cognitive Psychology, 12*, 119–131. DOI:10.1002/(SICI)1099-0720(199804)12:2<119::AID-ACP500>3.0.CO;2-4

Buller, D. B., & Burgoon, J. K. (1996). Interpersonal deception theory. *Communication Theory, 6*, 203–242. DOI: 10.1111/j.1468-2885.1996.tb00127.x

Carlson, C. A., Dias, J. L., Weatherford, D. R., & Maria, A. C. (2016) An investigation of the weapon focus effect and the confidence–accuracy relationship for eyewitness identification. *Journal of Applied Research in Memory and Cognition*, *6,* 82-92. DOI: 10.1016/j.jarmac.2016.04.001

Carver, C. S., & Scheier, M. F. (2002). Control processes and self-organization as complementary principles underlying behavior. *Personality and Social Psychology Review, 6*, 304–315. DOI: 10.1207/S15327957PSPR0604_05

Cambridge Dictionary (2018). *Consistency.* Retrieved from https://dictionary.cambridge.org/dictionary/english/consistency

Clarke, C., Milne, R., & Bull, R. (2011). Interviewing suspects of crime: The impact of PEACE training, supervision and the presence of a legal advisor. *Journal of Investigative Psychology and Offender Profiling, 8,* 149-162. DOI: 10.1002/jip.144

Colwell, K., Hiscock-Anisman, C. K., Memon, A., Taylor, L., & Prewett, J. (2007). Assessment criteria indicative of deception (ACID): An integrated system of investigative interviewing and detecting deception. *Journal of Investigative Psychology and Offender Profiling, 4*, 167–180. DOI:10.1002/jip.73

Dando, C., Wilcock, R., & Milne, R. (2009). The cognitive interview: the efficacy of a modified mental reinstatement of context procedure for frontline police investigators. *Applied Cognitive Psychology, 23*, 138–147. DOI: 10.1002/acp.1501

Debey, E., Verschuere, B., & Crombez, G. (2012). Lying and executive control: An experimental investigation using ego depletion and goal neglect. *Acta Psychologica, 140*, 133–141. DOI: 10.1016/j.actpsy.2012.03.004

Deeb, H., Granhag, P. A., Vrij, A., Strömwall, L. A., Hope, L., & Mann, S. (2018). Visuospatial counter-interrogation strategies by liars familiar with the alibi setting. *Applied Cognitive Psychology, 32*, 105–116. DOI: 10.1002/acp.3383

Deeb, H., Vrij, A., Hope, L., Mann, S., Granhag, P. A., & Lancaster, G. (2017). Suspects' consistency in statements concerning two events when different question formats are used. *Journal of Investigative Psychology and Offender Profiling, 14*, 74-87. DOI: 10.1002/jip.1464

De Keijser, J., Malsch, M., Kranendonk, R., & de Gruijter, M. (2011). Written records of police interrogation: differential registration as determinant of statement credibility and

interrogation quality. *Psychology, Crime, & Law, 18,* 613-629. DOI: 10.1080/1068316X.2010.526119

DePaulo, B. M. (1992). Nonverbal behavior and self-presentation. *Psychological Bulletin, 111*, 203-243. DOI: 10.1037/0033-2909.111.2.203

DePaulo, B. M., & Kirkendol, S. E. (1989). The motivational impairment effect in the communication of deception. In J. C. Yuille (Ed.), *Credibility assessment* (pp. 51–70). Dordrecht, the Netherlands: Kluwer.

DePaulo, B. M., Kashy, D. A., Kirkendol, S. E., Wyer, M. M., & Epstein, J. A. (1996). Lying in everyday life. *Journal of Personality and Social Psychology, 70*, 979-995. DOI: 10.1037/0022-3514.70.5.979

DePaulo, B. M., Lindsay, J. L.,Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to deception. *Psychological Bulletin, 129*, 74–118. DOI: 10.1037/0033-2909.129.1.74

Dornburg, C. C., & McDaniel, M. A. (2006). The cognitive interview enhances long-term free recall of older adults. *Psychology and Aging, 21*, 196-200. DOI: 10.1037/0882-7974.21.1.196

Dostoevsky, F. (1866). *Crime and Punishment.* W. W. Norton & Company, Inc.

Ebbinghaus, H. (1885/1913). *Memory: A contribution to experimental psychology*. New York: Teachers College, Columbia University.

Ekman, P., & Friesen, W. V. (1969). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica, 1,* 49-98. DOI: 10.1515/semi.1969.1.1.49

Evans, J. R., & Fisher, R. P. (2011). Eyewitness memory: Balancing the accuracy, precision and quantity of information through metacognitive monitoring and control. *Applied Cognitive Psychology, 25,* 501-508. DOI: 10.1002/acp.1722

Evans, J. R., Meissner, C. A., Brandon, S. E., Russano, M. B., & Kleinman, S. M. (2010). Criminal versus HUMINT interrogations: The importance of psychological science to improving interrogative practice. *The Journal of Psychiatry and Law, 38,* 215-249. DOI: 10.1177/009318531003800110

Feather, N. T. (1999). Judgments of deservingness: Studies in the psychology of justice and achievement. *Personality and Social Psychology Review, 3*, 86–107. DOI: 10.1207/s15327957pspr0302_1

Fisher, R., & Geiselman, R. (1992). *Memory-enhancing techniques for investigativeinterviewing: The cognitive interview*. Springfield, IL: Thomas.

Fisher, R. P., & Geiselman, R. E. (2010). The cognitive interview method of conducting police interviews: Eliciting extensive information and promoting therapeutic jurisprudence. *International Journal of Law and Psychiatry, 33*, 321-328. DOI: 10.1016/j.ijlp.2010.09.004

Fiske, S. T., & Taylor, S. (2008) *A social cognition: From brain to culture*. McGraw-Hill Higher Education.

Flexser, A., & Tulving, E. (1978). Retrieval independence in recognition and recall. *Psychological Review, 85,* 153-171.

Fritz, C. O., Morris, P. E., & Richler, J. J. (2012). Effect size estimates: Current use, calculations and interpretation. *Journal of Experimental Psychology: General*, *141*, 2-18, DOI: 10.1037/a0024338

Gabbert, F., Hope, L., Carter, E., Boon, R., & Fisher, R. (2016). The role of initial accounts within the investigative process. In G. Oxburgh, T. Myklebust, T. Grant & R. Milne (Eds.), *Communication in Investigative and Legal Contexts* (pp. 107–131). Chichester, UK: Wiley.

Gabbert, F., Hope, L., & Fisher, R. P. (2009). Protecting eyewitness evidence: Examining the efficacy of a Self-Administered Interview tool. *Law & Human Behavior, 33*, 298–307. DOI:10.1007/s10979-008-9146-8

Gilovich, T., Savitsky, K., & Medvec, V. H. (1998). The illusion of transparency: Biased assessments of others' ability read one's emotional states. *Journal of Personality and Social Psychology, 75,* 332–346. DOI: 10.1037/0022-3514.75.2.332

Global Deception Research Team (2006). A world of lies. *Journal of Cross-Cultural Psychology, 37*, 60–74. DOI: 10.1177/0022022105282295

Goffman, E. (1959). *The presentation of self in everyday life*. Garden City, NY: Doubleday/Anchor Books.

Goldsmith M., Koriat A., & Pansky, A. (2005). Strategic regulation of grain size in memory reporting over time. *Journal of Memory and Language, 52,* 505-525. DOI: 10.1016/j.jml.2005.01.010

Gozna, L., & Horvath, M. A. H. (2009). Investigative interviewing. In S. Tong, R. P. Bryant, & M. A. H. Horvath (Eds.), *Understanding criminal investigation* (pp. 115–133). Chichester: Wiley. DOI: 10.1002/9780470682388.ch6

Granhag, P. A., & Hartwig, M. (2008). A new theoretical perspective on deception detection: On the psychology of instrumental mind reading. *Psychology, Crime & Law, 14*, 189–200. DOI: 10.1080/10683160701645181

Granhag, P. A., & Hartwig, M. (2015). The strategic use of evidence technique: A conceptual overview. In P. A. Granhag, A. Vrij & B. Verschuere (Eds.), *Detecting Deception Current Challenges and Cognitive Approaches* (pp. 231–252). Chichester, UK: Wiley. DOI: 10.1002/9781118510001.ch1

Granhag, P. A., Mac Giolla, E., Sooniste, T., Strömwall, L. A., & Liu-Johnson, M. (2016). Discriminating between statements of true and false intent: The impact of repeated interviews and strategic questioning, *Journal of Applied Security Research, 11,* 1-17. DOI: 10.1080/19361610.2016.1104230

Granhag, P. A., & Strömwall, L. A. (1999). Repeated interrogations-Stretching the deception detection paradigm. *Expert Evidence, 7,* 163–174. DOI:10.1023/a:1008993326434

Granhag, P. A., & Strömwall, L. A. (2002). Repeated interrogations: Verbal and non-verbal cues to deception. *Applied Cognitive Psychology, 16,* 243-257. DOI: 10.1002/acp.784

Granhag, P. A., Strömwall, L. A., & Jonsson, A. (2003). Partners in crime: How liars in collusion betray themselves. *Journal of Applied Social Psychology, 33*, 848-868. doi:10.1111/j.1559-1816.2003.tb01928.x

Hagsand A., Roos af Hjelmsäter E. , Granhag, P. A., Fahlke, C., & Söderpalm-Gordh, A. (2013). Bottled memories: On how alcohol affects eyewitness recall. *Scandinavian Journal of Psychology*, *54*, 188–195. DOI: 10.1111/sjop.12035

Hartwig, M., & Bond, C. F., Jr. (2011). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin, 137,* 643–659. DOI: 10.1037/a0023589

Hartwig, M., Granhag, P. A., & Luke, T. (2014). Strategic use of evidence during investigative interviews: The state of the science. In: Raskin, D.C., Honts, C.R., Kircher, J.C. (Eds.), *Credibility assessment: Scientific research and applications* (pp. 1-36). Oxford, UK: Academic Press.

Hartwig, M., Granhag, P. A., & Strömwall, L. A. (2007). Guilty and innocent suspects' strategies during police interrogations. *Psychology, Crime & Law, 13,* 213–227. DOI: 10.1080/10683160600750264

Hartwig, M., Luke, T. J., & Skerker, M. (2016). Ethical perspectives on interrogation: An analysis of contemporary techniques. In J. Jackobs & J. Jackson (Eds.), *The Routledge handbook of criminal justice* (pp. 326–347). Taylor & Francis Group.

Harvey, A., Vrij, A., Leal, S., Hope, L., & Mann, S. (2017a). A stability bias effect amongst deceivers. *Law and Human Behavior, 41,* 519–529. DOI: 10.1037/lhb0000258

Harvey, A., Vrij, A., Leal, S., Hope, L., & Mann, S. (2017b). Deception and decay: Verbal lie detection as a function of delay and encoding quality. *Journal of Applied Research in Memory and Cognition*, *6*, 306-318. DOI: 10.1016/j.jarmac.2017.04.002

Hauch, V., Sporer, S. L., Michael, S. W., & Meissner, C. A. (2016). Does training improve the detection of deception? A meta-analysis. *Communication Research, 43*, 283-343. DOI: 10.1177/0093650214534974

Hernández-Fernaud, E., & Alonso-Quecuty, M. (1997). The cognitive interview and lie detection: A new magnifying glass for Sherlock Holmes? *Applied Cognitive Psychology, 11*, 55-58. DOI: 10.1002/(SICI)1099-0720(199702)11:1<55::AID-ACP423>3.0.CO;2-G

Hope, L., Gabbert, F., & Fisher, R. (2011). From laboratory to the street: Capturing witness memory using the Self-Administered Interview. *Legal and criminological psychology, 16*, 211-226. DOI: 10.1111/j.2044-8333.2011.02015.x

Hope, L., Gabbert, F., Fisher, R. P., & Jamieson, K. (2014). Protecting and enhancing eyewitness memory: The impact of an initial recall attempt on performance in an investigative interview. *Applied Cognitive Psychology, 28*, 304-313. DOI:10.1002/acp.2984

Hope, L., Mullis, R., & Gabbert, F. (2013). Who? What? When? Using a timeline technique to facilitate recall of a complex event. *Journal of Applied Research in Memory and Cognition, 2,* 20-24. DOI: 10.1016/j.jarmac.2013.01.002

Inbau, F. E., Reid, J. E., Buckley, J. P., & Jayne, B. C. (2001). *Criminal interrogation and confessions, fourth edition*. Gaithersburg, Maryland: Aspen.

Inbau, F. E., Reid, J. E., Buckley, J. P., & Jayne, B. C. (2013). *Criminal interrogation and confessions* (5th ed). Sudbury, MA: Jones and Bartlett.

Innes, M. (2000). 'Professionalizing' the role of the police informant: The British experience. *An international Journal of Research and Policy, 9,* 357-383. DOI: 10.1080/10439463.2000.9964823

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review, 88,* 67-85. DOI: 10.1037/0033-295X.88.1.67

Kassin, S. M. (2015). The social psychology of false confessions. *Social Issues and Policy Review, 9*, 25-51. DOI: 10.1111/sipr.12009

Kassin, S. M., Leo, R. A., Meissner, C. A., Richman, K. D., Colwell, L. H., Leach, A. M., & La Fon, D. (2007). Police interviewing and interrogation: A self-report survey of police practices and beliefs. *Law and Human Behavior, 31*, 381–400. DOI: 10.1007/s10979-006-9073

Kaufmann, W. (1994). *The portable Nietzsche.* Viking Penguin Inc.

Kelly, C. E., Miller, J. C., Redlich, A. D., & Kleinman, S. M. (2013). A taxonomy of interrogation methods. *Psychology, Public Policy, and Law, 19*, 165-178. DOI: 10.1037/a0030310

Köhnken, G., Milne, R., Memon, A. & Bull, R. (1999). The cognitive interview: A meta-analysis. *Psychology, Crime & Law, 5*, 3-27. DOI: 10.1080/10683169908414991

Krix, A. C., Sauerland, M., Lorei, C., Rispens, I. (2015). Consistency across repeated eyewitness interviews: Contrasting police detectives' beliefs with actual eyewitness performance. *Plos One, 10*, 1–17. DOI: 10.1371/journal.pone.0118641

Lancaster, G. L., Vrij, A., Hope, L., & Waller, B. (2013), Sorting the liars from the truth tellers: The benefits of asking unanticipated questions on lie detection. *Applied Cognitive Psychology, 27*, 107-114. DOI:10.1002/acp.2879

Larsson, A. S., Granhag, P. S., & Spjut, E. (2003). Children's recall and the cognitive interview: do the positive effects hold over time? *Applied Cognitive Psychology, 17*, 203-214. DOI:10.1002/acp.863

Lawson, M., & London, K. (2015). Tell me everything you discussed: Children's memory for dyadic conversations after a 1-Week or a 3-Week delay. *Behavioral Sciences & Law, 33,* 429-445. DOI: 10.1002/bsl.2184

Leins, D. A., Fisher, R. P., & Vrij, A. (2012). Drawing on liars' lack of cognitive flexibility: Detecting deception through varying report modes. *Applied Cognitive Psychology, 26*, 601–607. DOI:10.1002/acp.2837.

Lerner, M. J. (1980). *The belief in a just world*. New York, NY: Plenum.

Levine, T. R., Kim, R. K., & Hamel, L. M. (2010). People lie for a reason: Three experiments documenting the principle of veracity. *Communication Research Reports, 27*, 271–285. DOI: 10.1080/08824096.2010.496334

Loftus, E. (2003). Our changeable memories: Legal and practical implications. *Nature Reviews Neuroscience volume, 4*, 231–234. DOI: 10.1038/nrn1054

Logue, M., Book, A. S., Frosina, P., Huizinga, T., & Amos, S. (2015). Using reality monitoring to improve deception detection in the context of the cognitive interview for suspects. *Law and Human Behavior, 39*, 360-367. DOI: 10.1037/lhb0000127

Luke, T. J., Hartwig, M., Joseph, E., Brimbal, L., Chan, G., Dawson, E., Jordan, S., Donovan, P., & Granhag, P. A. (2016). Training in the Strategic Use of Evidence technique: Improving deception detection accuracy of American law enforcement officers.

*Journal of Police and Criminal Psychology, 31*, 270-278. DOI: 10.1007/s11896-015-9187-0

Mac Giolla, E., Granhag, P. A., & Vernham, Z. (2017). Drawing-based deception detection techniques: A state-of-the-art review. *Crime Psychology Review, 3,* 23-38. DOI: 10.1080/23744006.2017.1393986

MacLeod, M. D. (2002). Retrieval-induced forgetting in eyewitness memory: Forgetting as a consequence of remembering. *Applied Cognitive Psychology, 16*, 135–149. DOI: 10.1002/acp.782

Mann, S., Vrij, A., & Bull, R. (2004). Detecting true lies: Police officers' ability to detect deceit. *Journal of Applied Psychology, 89*, 137–149. DOI: 10.1037/0021-9010.89.1.137

Masip, J., Martínez, C., Blandón-Gitlin, I., Sánchez, N., Herrero, C., & Ibabe, I. (2018). Learning to detect deception from evasive answers and inconsistencies across repeated interviews: A study with lay respondents and police officers. *Frontiers in Psychology, 8*, 1-17. DOI: 10.3389/fpsyg.2017.02207

Masip, J., Sporer, S. L., Garrido, E., & Herrero, C. (2005). The detection of deception with the reality monitoring approach: A review of empirical evidence. *Psychology, Crime & Law, 11,* 99-122. DOI: 10.1080/10683160410001726356

McDougall, A. G., & Bull, R. (2015). Detecting truth in suspect interviews: The effect of use of evidence (early and gradual) and time delay on Criteria-Based Content Analysis, Reality Monitoring and inconsistency within suspect statements. *Psychology, Crime & Law, 21,* 514-530. DOI: 10.1080/1068316X.2014.994631

Memon, A., Fraser, J., Colwell, K., Odinot, G., & Mastroberardino, S. (2010). Distinguishing truthful from invented accounts using reality monitoring criteria. *Legal and Criminological Psychology, 15*, 177–194. DOI: 10.1348/135532508X401382

Memon, A., Meissner, C. A., & Fraser, J. (2010). The cognitive interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law*, *16*, 340–372. DOI:10.1037/a0020518

Meissner, C. A., Redlich, A. D., Michael, S. W., Evans, J. R., Camilletti, C. R., Bhatt, S., & Brandon, S. (2014). *Journal of Experimental Criminology, 10*, 459-486. DOI: 10.1007/s11292-014-9207-6

Meissner, C. A., Surmon-Böhr, F.,Oleszkiewicz, S. A., & Laurence J. (2017). Developing an evidence-based perspective on interrogation: A review of the U.S. government's high-value detainee interrogation group research program. *Psychology, Public Policy, and Law, 23*, 438-457. DOI: 10.1037/law0000136

Miller, G. R., & Stiff, J. B. (1993). *Deceptive communication*. Newbury Park, CA: Sage.

Milne, R. & Bull, R. (1999) *Investigative Interviewing: Psychology and Practice.* Wiley, Chichester.

Nahari, G. (2018). Reality monitoring in the forensic context: Digging deeper into the speech of liars. *Journal of Applied Research in Memory and Cognition, 7,* 432-440. DOI: 10.1016/j.jarmac.2018.04.003

Nahari, G., & Ben-Shakhar, G. (2011). Psychophysiological and behavioral measures for detecting concealed information: The role of memory for crime details. *Psychophysiology, 48*, 733–744. DOI:10.1111/j.1469-8986.2010.01148.x

Nahari, G., Vrij, A., & Fisher, R. P. (2014). Exploiting liars' verbal strategies by examining the verifiability of details. *Legal and Criminological Psychology, 19*, 227-239. DOI:10.1111/j.2044-8333.2012.02069.x

Oberlader, V.A., Naefgen, C., Koppehele-Gossel, J., Quinten, L., Banse, R., & Schmidt, A.F. (2016). Validity of content-based techniques to distinguish true and fabricated statements: A meta-analysis. *Law and Human Behavior, 40*, 440–457. DOI: 10.1037/lhb0000193

Odinot, G. & Wolters, G. (2006). Repeated recall, retention interval and the accuracy–confidence relation in eyewitness memory. *Applied Cognitive Psychology, 20*, 973-985. DOI:10.1002/acp.1263

Oxburgh, G., Fahsing, I., Haworth, K., & Blair, J. P. (2016). Interviewing suspected offenders. In G. Oxburgh, T. Myklebust, T. Grant and R. Milne (Eds.), *Communication in investigative and legal contexts* (pp. 135-157). Chichester, UK: Wiley. DOI:10.1002/9781118769133.ch7

Oxburgh, G., Myklebust, T., & Grant, T. (2010). The question of question types in police interviews: A review of the literature from a psychological and linguistic perspective. *International Journal of Speech Language and the Law, 17*, 45–66. DOI: 10.1558/ijsll.v17i1.45

Ozin, P., & Norton, H. (2015). *PACE: A practical guide to the Police and Criminal Evidence Act 1984* (4th ed). Blackstone's Practical Policing.

Pansky, A., & Nemets, E. (2012). Enhancing quantity and accuracy of eyewitness memory viea initial memory testing. *Journal of Applied Research in Memory and Cognition, 1*, 2-10. DOI: 10.1016/j.jarmac.2011.06.001

Pansky, A, Koriat, A., & Goldsmith, M. (2005). Eyewitness recall and testimony. In N. Brewer & K. D. Williams, *Psychology and law: An empirical perspective* (pp. 93-150). The Guilford Press, New York.

Pescod, L., Wilcock, L., & Milne, R. (2013). Improving eyewitness memory in police call centre interviews. *Policing: A Journal of Policy and Practice, 7*, 299–306. DOI:10.1093/police/pat013

Porter, S., & ten Brinke, L. (2010). The truth about lies: What works in detecting high-stakes deception? *Legal and Criminological Psychology, 15,* 57-75. DOI: 10.1348/135532509X433151

Porter, C. N., Vrij, A., Leal, S., Vernham, Z., Salvanelli, G., & Mcintyre, N. (2018). Using specific model statements to elicit information and cues to deceit in information-gathering interviews. *Journal of Applied Research in Memory and Cognition, 7,* 132-142. DOI: 10.1016/j.jarmac.2017.10.003

Read, J. D., & Connolly, D. A. (2007). The effects of delay on long-term memory for witnessed events. In M. P. Toglia, J. D. Read., D. F. Ross, R. C. L. Lindsay, *The handbook of eyewitness psychology: Vol. 1. Memory for events* (pp. 117-155). Mahwah, NJ: Lawrence Erlbaum Associates.

Reber, A. S., Reber, M., & Allen, R. (2009). *Penguin dictionary of psychology* (4th ed). Penguin Reference Library.

Redlich, A. D. (2007). Military versus police interrogations: Similarities and differences. *Peace and Conflict: Journal of Peace Psychology, 13*, 423-428. DOI: 10.1080/10781910701665741

Rivard, J. R., Fisher, R., Robertson, B., & Mueller, D. H. (2014). Testing cognitive interview with professional interviewers: Enhancing recall of specific details of recurring events. *Applied Cognitive Psychology, 28,* 917–925. DOI: 10.1002/acp.3026

Robinson, W. P., (1994). Reactions to falsifications in public and and interpersonal contexts. *Journal of Language and Social Psychology, 13*, 497–513. DOI: 10.1177/0261927X94134007

Roediger, H. L. III, & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences, 15,* 20-27. DOI: 10.1016/j.tics.2010.09.003

Roediger, H. L. III, McDermott, K. B., & Goff, L. M. (1997). Recovery of true and false memories: Paradoxical effects of repeated testing. In M. A. Conway (Ed.), *Debates in psychology. Recovered memories and false memories* (pp. 118-149). New York, NY, US: Oxford University Press. DOI: 10.1093/med:psych/9780198523864.003.0006

Roos af Hjelmsäter, E., Öhman, L., Granhag, P. A., & Vrij, A. (2014). 'Mapping' deception in adolescents: Eliciting cues to deceit through an unanticipated spatial drawing task. *Legal and Criminological Psychology, 19*, 179–188. DOI:10.1111/j.2044-8333.2012.02068.x

Rubin, D. C., & Wenzel, A. E. (1996). One hundred years of forgetting: A quantitative description of retention. *Psychological Review, 103*, 734-760. DOI: 10.1037/0033-295X.103.4.734

Sakrisvold, M. L., Granhag, P. A., & Mac Giolla, E. (2017) Partners under pressure: Examining the consistency of true and false alibi statements. *Behavioral Sciences & Law*, *35,* 75–90. DOI: 10.1002/bsl.2275

Savitsky, K., & Gilovich, T. (2003). The illusion of transparency and the alleviation of speech anxiety. *Journal of Experimental Social Psychology, 39*, 618–625. DOI: 10.1016/S0022-1031(03)00056-8

Schacter, D. L. (1999). The seven sins of memory: Insights from psychology and neuroscience. *American Psychology, 54,* 182-203. DOI: 10.1037/0003-066X.54.3.182

Schweitzer, M. E., Brodt, S. E., & Croson, R. T. A. (2002). Seeing and believing: Visual access and the strategic use of deception. *The International Journal of Conflict Management, 13*, 258–275. DOI: 10.1108/eb022876

Shaw, J. S., Bjork, R. A., & Handal, A. (1995). Retrieval-induced forgetting in an eyewitness paradigm. *Psychonomic Bulletin & Review, 2,* 249-253. DOI: 10.3758/BF03210965

Snook, B., Eastwood, J., Stinson, M., Tedeschini, J., & House, J. C. (2010). Reforming investigative interviewing in Canada. *Canadian Journal of Criminology and Criminal Justice, 52*, 215-229. DOI: 10.1177/0093854811412170

Sooniste, T., Granhag, P.A. & Strömwall, L.A. (2017). Training police investigators to interview to detect false intentions. *Journal of Police and Criminal Psychology*, *32,* 152-162. DOI: 10.1007/s11896-016-9206-9

Sooniste, T., Granhag, P. A., Strömwall, L. A. & Vrij, A. (2015). Statements about true and false intentions: Using the Cognitive Interview to magnify the differences. *Scandinavian Journal of Psychology*, 56, 371–378. DOI: 10.1111/sjop.12216

Sporer, S. L., & Schwandt, B. (2006). Paraverbal indicators of deception: A meta-analytic synthesis. *Applied Cognitive Psychology, 20*, 421-446. DOI:10.1002/acp.1190

Steller, M., & Köhnken, G. (1989). Criteria-based statement analysis. In D. C. Raskin (Ed.), *Psychological methods in criminal investigation and evidence* (pp. 217–245). New York, NY: Springer.

Strömwall, L. A., & Granhag, P. A. (2005). Children's repeated lies and truths: Effects on adults' judgements and reality monitoring scores. *Psychiatry, Psychology and Law, 12,* 345–356. DOI: 10.1375/pplt.12.2.345

Strömwall, L. A., Granhag, P.A. & Hartwig, M. (2004). Practitioner's beliefs about deception. In P. A. Granhag & L. A. (Eds.), *The detection of deception in forensic contexts* (pp. 229–250). Cambridge: Cambridge University Press.

Tuckey, M. R., & Brewer, N. (2003). The influence of schemas, stimulus ambiguity, and interview schedule on eyewitness memory over time. *Journal of Experimental Psychology: Applied, 9*, 101-118. DOI: 10.1037/1076-898X.9.2.101

Tulving, E. (1974). Cue-dependent forgetting. *American Scientist, 62,* 74-82.

Turtle, J. W., & Yuille, J. C. (1994). Lost but not forgotten details: Repeated eyewitness recall leads to reminiscence but not hypermnesia. *Journal of Applied Psychology, 79,* 260-271. DOI: 10.1037/0021-9010.79.2.260

Undeutsch, U. (1967). Beurteilung der glaubhaftigkeit von aussagen. In U. Undeutsch (Ed.), *Handbuch der psychologie, Vol. 11: Forensische psychologie* (pp. 26-181). Göttingen, Germany: Hogrefe.

Verschuere, B., Spruyt, A., Meijer, E. H., & Otgaar, H. (2011). The ease of lying. *Consciousness and Cognition, 20*, 908–911. DOI: 10.1016/j.concog.2010.10.023

Visu-Petra, G., Varga, M., Miclea, M., & Visu-Petra, L. (2013). When interference helps: Increasing executive load to facilitate deception detection in the concealed information test. *Frontiers in Psychology, 4*, 146. DOI:10.3389/fpsyg.2013.00146

Volbert, R., & Steller, M. (2014). Is this testimony truthful, fabricated, or based on false memory? Credibility assessment 25 years after Steller and Köhnken (1989). *European Psychologist, 19*, 207-220. DOI: 10.1027/1016-9040/a000200

Vredeveldt, A., van Koppen, P. J., & Granhag, P. A. (2014). The inconsistent suspect: A systematic review of different types of consistency in truth tellers and liars. In R. Bull (Ed.), *Investigative interviewing* (pp. 183–207). New York, NY: Springer. DOI: 10.1007/978-1-4614-9642-7_10

Vrij, A. (2005). Criteria-Based Content Analysis: A qualitative review of the first 37 Studies. Psychology, *Public Policy, and Law, 11,* 3-41. DOI: 10.1037/1076-8971.11.1.3

Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities*. Chichester, UK: John Wiley & Sons.

Vrij, A. (2015). Verbal lie detection tools: Statement validity analysis, reality monitoring and scientific content analysis. In P. A. Granhag, A. Vrij & B. Verschuere (Eds.),

*Detecting deception: Current challenges and cognitive Approaches* (pp. 3–36). Chichester, UK: Wiley. DOI: 10.1002/9781118510001.ch1

Vrij, A. (2016). Baselining as a lie detection method. *Applied Cognitive Psychology, 30,* 1112-1119. DOI: 10.1002/acp.3288

Vrij, A. (2018). Verbal lie detection tools from an applied perspective. In J. P. Rosenfeld (Ed.), *Detecting concealed information and deception: Recent developments* (pp. 297-326). Elsevier Inc. DOI: 10.1016/B978-0-12-812729-2.00013-6

Vrij, A., Fisher, R., & Blank, H. (2017a). A cognitive approach to lie detection: A meta-analysis. *Legal and Criminological Psychology, 22,* 1-21. DOI:10.1111/lcrp.12088

Vrij, A., & Granhag, P. A. (2012). Eliciting cues to deception and truth: What matters are the questions asked. *Journal of Applied Research in Memory and Cognition, 1*, 110–117. DOI: 10.1016/j.jarmac.2012.02.004

Vrij, A., Granhag, P. A., Mann, S., & Leal, S. (2011). Lying about flying: The first experiment to detect false intent. *Psychology, Crime & Law, 17*, 611–620. DOI: 10.1080/10683160903418213

Vrij, A., Leal, S., Fisher, R. P., Mann, S., Dalton, G., Jo, E., Shaboltas, A., Khaleeva, M., Granskaya, J., & Houston, K. (2018). Sketching as a technique to eliciting information and cues to deceit in interpreter-based interviews. *Journal of Applied Research in Memory and Cognition, 7,* 303-313. DOI: 10.1016/j.jarmac.2017.11.001

Vrij, A., Leal, S., Granhag, P. A., Mann, S., Fisher, R. P., Hillman, J., & Sperry, K. (2009). Outsmarting the liars: The benefit of asking unanticipated questions. *Law and Human Behavior, 33*, 159-166. DOI: 10.1007/s10979-008-9143-y

Vrij, A., Leal, S., Mann, S., Warmelink, L., Granhag, P. A., & Fisher, R. P. (2010). Drawings as an innovative and successful lie detection tool. *Applied Cognitive Psychology, 24*, 587–594. DOI:10.1002/acp.1627

Vrij, A., Mann, S., & Fisher, R. P. (2006). An empirical test of the Behaviour Analysis Interview. *Law and Human Behavior, 30*, 329-345. DOI: 10.1007/s10979-006-9014-3

Vrij, A., Meissner, C. A., Fisher, R. P., Kassin, S. M., Morgan, C. A. III, & Kleinman, S. M. (2017b). Psychological perspectives on interrogation. *Perspectives on Psychological Science*, *12*, 927-955. DOI: 10.1177/1745691617706515

Vrij, A., Leal, S., Mann, S., Vernham, Z., & Brankaert, F. (2015). Translating theory into practice: Evaluating a cognitive lie detection training workshop. *Journal of Applied Research in Memory and Cognition, 4*, 110-120. DOI: 10.1016/j.jarmac.2015.02.002

Wells, G. L., & Olson, E. A. (2003). Eyewitness testimony. *Annual Review of Psychology, 54,* 277-295. DOI: 10.1146/annurev.psych.54.101601.145028

Wright Whelan, C., Wagstaff, G. F., & Wheatcroft, J. M. (2015) Subjective cues to deception/honesty in a high stakes situation: An exploratory approach. *The Journal of Psychology, 149*, 517-534. DOI: 10.1080/00223980.2014.911140

Wright, C., & Wheatcroft, J. M. (2017). Police officers' beliefs about, and use of, cues to deception. *Journal of Investigative Psychology and Offender Profiling*, *14*, 307–319. DOI: 10.1002/jip.1478

Wysman, L., Scoboria, A., Gawrylowicz, J., & Memon, A. (2014). The cognitive interview buffers the effects of subsequent repeated questioning in the absence of negative feedback. *Behavioral Sciences and Law, 32,* 207-219. DOI: 10.1002/bsl.2115

Zimbardo, P.G. (1967). The psychology of police confessions. *Psychology Today, 1*, 17-20, 25-27. DOI: 10.1111/j.1529-1006.2004.00016.x

Zöhner, M. (2011). The problems and limits of fair credibility assessment in German criminal law. Discussion about systematization and improvement of the procedure of credibility assessment. *Internal Security, 3,* 105-130.

Zuckerman, M., DePaulo, B. M., & Rosenthal, R. (1981). Verbal and nonverbal communication of deception. *Advances in Experimental Social Psychology, 14,* 1-57. DOI: 10.1016/S0065-2601(08)60369-X

# APPENDIX

Table 3.3

*Between-statement consistency characteristics as a function of veracity and mnemonic conditions across Studies I-III (without the addition of covariates)*

| | Truth | | | Lie | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Measure** | *M* | *SD* | 95% CI | *M* | *SD* | 95% CI | *F* | *p* | *d* |
| **Study I** | | | | | | | | | |
| | | | | CR | | | | | |
| Reminiscence | 22.33 | 13.42 | 16.35,28.32 | 13.00 | 8.55 | 6.89,19.11 | 4.66 | .033 | 0.83 |
| Repetition | 119.75 | 43.24 | 101.16,138.35 | 80.30 | 52.87 | 61.31,99.30 | 8.61 | .004 | 2.07 |
| Omission | 34.54 | 28.03 | 25.14,43.95 | 19.22 | 14.72 | 9.61,28.83 | 5.08 | .26 | 0.62 |
| | | | | Sketch | | | | | |
| Reminiscence | 23.61 | 20.96 | 17.50,29.72 | 20.00 | 17.01 | 14.25,25.75 | 0.72 | .397 | 0.19 |
| Repetition | 145.09 | 62.36 | 126.09,164.08 | 72.42 | 32.27 | 54.56,90.29 | 30.36 | <.001 | 1.46 |
| Omission | 32.61 | 21.89 | 23.00,42.22 | 27.85 | 30.00 | 18.81,36.88 | 0.51 | .476 | 0.18 |
| | | | | Event-line | | | | | |
| Reminiscence | 19.61 | 13.86 | 13.50,25.72 | 16.92 | 11.86 | 10.93,22.90 | 0.39 | .535 | 0.21 |
| Repetition | 137.43 | 43.74 | 118.44,156.43 | 77.83 | 37.64 | 59.24,96.43 | 19.66 | <.001 | 1.46 |
| Omission | 26.09 | 23.46 | 16.48,35.70 | 19.42 | 16.67 | 10.01,28.82 | 0.96 | .328 | 0.33 |
| **Study II** | | | | | | | | | |
| | | | | Sketch | | | | | |
| Reminiscence | 19.44 | 11.39 | 15.38, 23.80 | 24.63 | 31.11 | 14.86,38.56 | 0.61 | .439 | 0.22 |
| Repetition | 80.52 | 55.87 | 59.54, 104.69 | 36.13 | 18.68 | 28.87,43.89 | 13.68 | .001 | 1.07 |
| Omission | 30.04 | 24.20 | 21.19,39.96 | 17.33 | 11.98 | 12.75,21.52 | 5.35 | .025 | 0.67 |
| **Study III** | | | | | | | | | |
| | | | | Report everything | | | | | |
| Reminiscence | 25.22 | 16.21 | 18.80,31.64 | 14.20 | 6.73 | 8.11,20.29 | 6.16 | .015 | 0.89 |
| Repetition | 123.67 | 50.00 | 109.27,138.06 | 42.90 | 20.96 | 29.24,56.56 | 65.73 | <.001 | 2.11 |
| Omission | 35.17 | 28.70 | 25.29,45.05 | 19.90 | 15.40 | 10.53,29.27 | 4.99 | .029 | 0.66 |
| | | | | Spatial questions | | | | | |
| Reminiscence | 36.91 | 17.87 | 31.10,42.72 | 14.70 | 10.69 | 8.61,20.79 | 27.64 | <.001 | 1.51 |
| Repetition | 65.09 | 21.78 | 52.07,78.11 | 31.45 | 23.68 | 17.79,45.11 | 12.61 | .001 | 1.48 |
| Omission | 30.96 | 15.60 | 22.02,39.90 | 30.15 | 22.99 | 20.78,39.52 | 0.15 | .902 | 0.04 |