The Effect of Individual Differences in Episodic Future Thinking Ability on the Ability to Tell the Truth and Lie Credibly

A DISSERTATION

By

Felicity O'Connell

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Declaration

I declare that this thesis and the work presented in it are entirely my own work completed under the supervision of Dr Lara Warmelink, Professor Paul Taylor, and Dr Zarah Vernham. None of this thesis has been submitted elsewhere in support of an application for the award of a higher degree. Parts of this thesis that have been published or submitted for publication in academic journals during the course of this doctoral degree have been highlighted in the Introduction Chapter and before the associated studies.

Date: 25.4.23

Abstract

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Given the extensive literature surrounding deception detection and the behavioural cues indicative of lying, much less is known about the individual differences in successful truth-telling and lying ability. This is surprising given the potential benefits of identifying individuals in which effective lying ability is required for specific job roles (e.g., undercover police officers, politicians, military leaders, lawyers, professional gamblers; Semrad et al., 2019), and the implications of credibility judgements for witnesses and suspects in the legal arena. The current thesis proposed that one potential underlying cognitive mechanism involved in the ability to appear credible when telling the truth and lying is Episodic Future Thought (i.e., the ability to mentally simulate future personal events; Szpunar, 2010; EFT). Across three studies we assessed whether EFT ability affects credibility judgements when individuals tell the truth and lie about future events as well as current events. We also explored whether the EFT ability and credibility relationship was affected by presentation modality (spoken/written/sketches). Finally, we examined whether the EFT ability of the sender affected participants subjective cue use when judging credibility. In Study 1, participants EFT ability was measured and participants performed a truthful task and deceptive task (Exp. 1a). Supporting the prediction, verbal statements provided by individuals with higher EFT ability showed characteristics associated with credibility (i.e., statement length and level of detail) to a greater extent than those with lower EFT ability. Higher EFT individuals were also judged as more truthful in their spoken deceptive (but not truthful) statements (Exp. 1b). Supporting our predictions, participants with higher EFT ability also provided longer and more detailed written statements than those with lower EFT ability (Exp. 2a), and higher EFT participants' truthful and deceptive written statements were also judged as more credible than lower EFT participants (Exp. 2b). Study 2 tested the prediction that the EFT ability of the sender will affect participants subjective cue use when judging the credibility of spoken and written statements. Supporting our hypotheses, EFT ability affected subjective cue use in spoken statements (Exp. 1) and written statements (Exp. 2). Based on the EFT and credibility findings from Study 1 and Study 2, in Study 3 we assessed whether the EFT ability and credibility relationship was found when participants described a truthful and deceptive current event (their occupation; in comparison to a future event in Study 1). Participants told the truth and lied about their occupation in a series of interviews. During the occupation interviews participants were asked to verbally describe the layout of their workplaces as well as sketch their workplace layout. As predicted, higher EFT individuals provided longer, more detailed, and more plausible verbal workplace layout descriptions, as well more plausible sketches (Exp. 1). However conflicting with our predictions, the EFT ability of the sender did not affect credibility judgements of the verbal descriptions (Exp. 2), or sketches (Exp. 3). In summary, EFT ability affected the ability to generate credible future and current events across modalities (spoken/written/sketched). Furthermore, EFT ability affected credibility judgements of future but not current events. A possible explanation for these findings is that EFT ability is an underlying cognitive mechanism relating to credibility when describing future specific events (i.e., intentions) rather than a general simulation ability unaffected by the temporal direction of the told truth/lie. This thesis contributes to the fields of individual differences in truth and lie telling ability and true and false intentions. It also makes a novel contribution to the field of EFT, proposing that in addition to the functional benefits of EFT (e.g., decision making, problem solving, emotion regulation, goal processing, implementation intentions, and planning, Schacter et al, 2017; Spuznar, 2010), EFT may also be involved in truth telling and lying behaviour.

List of Publications

This thesis is based on the following three papers:

O'Connell, F., Carter, C., Taylor, P., Vernham, Z., & Warmelink, L. (2023). The Effect of Individual Differences in Episodic Future Thought on perceived credibility. *Psychology, Crime & Law.* DOI: 10.1080/1068316X.2023.2226293

O'Connell, F., Vernham, Z., Taylor, P., & Warmelink, L. (2023). The Effect of Episodic Future Thinking Ability on Subjective Cue Use when Judging Credibility. *Legal and Criminological Psychology.* https://doi.org/10.1111/lcrp.12241

O'Connell, F., Stone, D., Taylor, P., Vernham, Z., & Warmelink, L. (2023). *The Effect of Episodic Future Thinking Ability on Telling the Truth and Lying in Occupation Interviews* [Manuscript submitted for publication]. Psychology Department. Lancaster University.

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Impact of Covid 19

After completing all of the studies that formed Chapter 4, we were unsure whether the EFT and credibility relationship found was due to a true EFT effect or that of the participants' talkativeness/willingness to engage with the tasks. We then devised a follow up series of studies to replicate the studies in Chapter 4 with the addition of a sketching task (to remove the talking element). This involved the same face to face experimental procedure as in Chapter 4. Almost halfway through data collection, Covid 19 restrictions were imposed, and we were forced to terminate the experiment. As we were unsure how long social distancing restrictions would remain in place, we decided to design a series of studies that could be carried out online. Due to finding an EFT and credibility relationship in Chapter 4, we felt it would be logical to explore what cues were influencing participants' credibility judgements i.e., what cues were making higher EFT individuals appear more credible? The stimuli derived from Chapter 4 were then used for credibility and cue ratings in Chapter 5. With the issues surrounding Covid and face to face interactions still cause for concern, we decided that the remaining studies would have to be conducted online. However, we still wished to retain the face-to-face element of interviewing participants and to continue to explore the effect of EFT on credibility in sketching modality. We therefore decided to proceed with interviewing participants online via MS Teams. We also asked participants to sketch the layout of their true and false workplaces and take a photograph of each sketch to upload to a secure folder. Pre 2020, carrying out interviews online may have been deemed as lacking ecological validity, however during this unprecedented time of the pandemic, the world was forced to move to the digital landscape and therefore participating in an interview online was (and still is) very much part of the norm.

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Chapter 1: Introduction to Thesis

Discriminating between truthful and deceptive intentions is a particular form of deception detection that focusses on future events. An intention is defined as an actor's mental state preceding a corresponding action, which unlike related concepts such as desires, come with a commitment to perform the action and are often based on some amount of planning (Granhag, 2010). Furthermore, the formation of future events or intentions is usually accompanied by mental images (Szpunar, 2010). This notion has led to the exploration of differences between truthful and deceptive intentions in research areas relating to goals (Ask et al., 2013); planning (Sooniste et al., 2013), and mental imagery (Knieps et al., 2013). Truth-tellers report evoking a mental image to a greater extent than liars and provide richer verbal descriptions of their mental image than liars (Granhag & Knieps, 2011). Differences have also been found between truthful and deceptive verbal statements about intentions (for a review see Granhag & Mac Giolla, 2014). Truthful intentions have been found to be more plausible (Vrij et al., 2011a), longer in length (Sooniste et al., 2013) and contain more details (Warmelink et al., 2013) than deceptive intentions. Despite the rapid growth of interest in true and false intentions in the deception research field, research examining the underlying cognitive mechanisms involved in telling the truth or lying is lacking (Blandón-Gitlin et al., 2014). A small number of cognitive processes have been examined in relation to deception ability for example, inhibitory control, task switching, working memory, and counterfactual thinking (Atkinson, 2019; Briazu et al., 2017; Maldonado et al., 2018). However, as will be discussed in Chapter 2, these studies have involved lying about a present or past event, not future events. The focus of this thesis is on the cognitive mechanisms that may be involved in the ability to tell the truth and lie about intentions. Drawing on prior evidence of individual differences in Episodic Future Thinking (EFT) ability (e.g., D'Argembeau & Van der Linden, 2006; D'Argembeau et al., 2010; Hill & Emery, 2013), the studies in this thesis explored whether differences in EFT ability affected the ability to tell the truth and lie about future and current events.

Aims of the Current Research

The main aim for this thesis was to explore whether EFT ability affected truth and lie telling ability from an individual differences approach. The secondary aim was to understand what cues influence credibility judgements, and whether cue use is affected by the EFT ability of the sender. Thirdly, we sought to examine whether EFT ability affects credibility when telling the truth and lying about current events as well as future events (i.e., intentions). Put simply, if EFT ability affects credibility, does this only apply to future related events or is this ability unrelated to temporal

direction? The following section provides a summary of the chapters and the empirical studies carried out for this thesis.

Summary of Chapters

Chapter 2: Literature Review

This chapter begins with an overview of the most dominant deception detection theories and how the lie detection methods derived from these theories (which were originally developed to detect lies about past events) have been adapted and used to study lying about future events, i.e., intentions. To understand the factors that influence veracity judgements of true and false intentions, deception cues are then discussed. Following this, I review the literature surrounding individual differences in truth-telling and lying ability. The theory of EFT will then be summarised and the prior empirical work exploring the relationship between EFT and lying about intentions are discussed. The effect of individual differences in EFT ability on the ability to tell the truth and lie about intentions was examined in the three studies forming the basis of this thesis. The findings are discussed in relation to deceptive intentions research including truth-telling and lying ability, the credibility of the sender, subjective cue use and the relationship to EFT.

Chapter 3: Episodic Future Thinking Tasks

The aim of this chapter was to use a variety of EFT measures to determine which single EFT task was the most valid measure to use in the subsequent studies throughout the thesis. Chapter 2 firstly outlines the literature on EFT measures and the five examination and generation measures (covering specificity, fluency, episodic details and phenomenology) that were chosen to use in the first study in this thesis (Study 1a in Chapter 3). Four of the tasks were adapted from D'Argembeau et al. (2010): an Episodic Details Task (EDT; which also included a Memory Characteristics Questionnaire to assess phenomenology), an Autobiographical Specificity Task (AST), and an Autobiographical Fluency Task (AFT). The Vividness of Visual Imagery Questionnaire (Marks, 1973) was also used assess the clarity of individual's visual imagery. To determine which single EFT task was the most valid measure to use in the subsequent studies, a number of statistical analyses were performed on participants scores on the future thinking measures and their performance on the truthful and deceptive responses in Study 1a (Chapter 3). Pearson Correlation was conducted to examine the relationship between responses on the EDT, AST, AFT, and VVIQ. Spearman rho correlation was conducted to test the relationship between responses across all phenomenological tasks: VVIQ; MCQ; and perceptual details of participants' most dominant truthful and deceptive mental image. An exploratory Principal components analysis on the EDT, AST, AFT, and VVIQ was

conducted to assess whether the number of tasks could be reduced for subsequent studies in this thesis. Linear regressions were used to examine whether each of the future thinking tasks predicted the number of details and number of words participants used when describing their truthful and deception mental image and their truthful and deceptive planning task in Study 1a (Chapter 3). The results showed that the EDT was the most suitable measure to use when measuring participants EFT ability in subsequent studies in Chapters 4 and 5.

Chapter 4: The Effect of Individual Differences in Episodic Future Thought on the Ability to Lie about Intentions (Published in Psychology, Crime and Law: https://doi.org/10.1080/1068316X.2023.2226293)

Four studies were conducted to explore how individual differences in EFT ability affected credibility when telling the truth and lying about a future event. In the first study (1a), participants EFT ability was measured, and participants completed a truthful and deceptive task. Participants were intercepted before executing their task and taken to a room to be interviewed. The results showed that higher EFT individuals generated more credible statements than lower EFT individuals (as measured by statement length and level of detail) than lower EFT individuals' statements. In Study 1b credibility was assessed via the veracity judgments of the verbal statements derived from Study 1a. It was found that when lying (but not when telling the truth), participants with higher EFT ability were judged as more credible than lower EFT participants. Studies 2a and 2b were conceptual replications of Studies 1a and 1b in written format. In Study 2a, participants EFT was measured and participants provided a truthful and deceptive written statement. The results showed that higher EFT individuals generated more credible written statements than lower EFT individuals (as measured by statement length and level of detail). In Study 2b, truthful and deceptive statements written by higher EFT individuals were judged as more credible than lower EFT individuals' statements. Overall, the results showed that EFT ability predicted the ability to generate credible truthful and deceptive verbal and written statements and deceptive verbal statements as well as truthful and deceptive written statements were judged as more credible.

Chapter 5: The effect of Episodic Future Thinking ability on subjective cue use when judging credibility (Published in Legal and Criminological Psychology: https://doi.org/10.1111/lcrp.12241)

Two studies were conducted to explore whether the EFT ability of the sender affected participants' subjective cue use when judging credibility. In Study 1, participants judged the credibility of verbal statements derived from Study 1a in Chapter 3 and indicated which cues

influenced their credibility judgements. The results showed that the EFT ability of the sender affected subjective cue use and participants were influenced by different subjective cues when judging truthful (vs. deceptive) verbal statements. Furthermore, three cues (unnecessary details, logical order and nervousness) mediated the relationship between EFT ability and veracity judgements. In Study 2 participants judged the credibility of written statements derived from Study 2a in Chapter 3 and indicated which cues influenced their credibility judgements. The results showed that the EFT ability of the sender affected subjective cue use and participants were influenced by the same cues in both veracity conditions. Additionally, four cues (unnecessary details, made sense, logical order and plausible) mediated the EFT ability – veracity judgement relationship in the deceptive condition. There were no mediation effects in the truthful condition. Overall, the findings from these two studies suggest that EFT ability is an underlying cognitive mechanism involved in creating a credible demeanour which can affect participants' veracity judgements and the cues present in higher EFT individual's accounts may be contributing to this credibility effect.

Chapter 6: The effect of Episodic Future Thinking ability on credibility in occupation interviews (currently under review at Applied Cognitive Psychology)

Three studies were conducted to explore whether individual differences in Episodic Future Thought (EFT) ability affected credibility when participants told the truth and lied about their occupation. Credibility was measured by the generation of credible truthful and deceptive verbal accounts and sketches (Study 1) and veracity judgments of verbal accounts (Study 2) and sketches (Study 3). In Study 1, participants with higher EFT ability generated more credible verbal accounts (as measured by number of perceptual details, statement length, level of detail and plausibility) and more plausible sketches than those with lower EFT ability. In Studies 2 and 3, EFT ability did not predict veracity judgements of the verbal accounts or sketches derived from Study 1. The findings across all studies suggest that EFT ability affects the ability to generate credible accounts however, EFT ability may only affect credibility judgements when the event being described in future oriented.

Chapter 7: General discussion

This chapter summarises the main findings from all the studies conducted in this thesis. The implications of the findings are discussed in relation to deceptive intentions research including: truth-telling and lying ability, the credibility of the sender, subjective cue use, and the relationship to EFT. Methodological limitations are discussed and considerations for future research are highlighted. Overall, the conclusion of this thesis is that EFT ability affects the ability to generate credible truthful

and deceptive statements about current *and* future events, whereas EFT ability only affects credibility judgements of statements about future, *not* current events.

Table 1.1 below outlines the studies included in this thesis, the connection between the studies, and the chapters in which the data is used.

Table 1.1

Outline of studies and connection between studies in this thesis

Paper	Study no. in chapter	Online vs. in person	Type of data	Connection with other studies	Data used in chapters
1 PCL	1a	In person	Interviews	Collect senders for Study 1b	4
				Collect senders for LCP Study 1	5
	1b	Online	Ratings	Rating of Study 1a	4
	2a	Online	Written Statements	Collect senders for Study 2b	4
				Collect senders for LCP Study 2	5
	2b	Online	Ratings	Rating of Study 2a	4
2 LCP	1	Online	Ratings	Rating of PCL Study 1a	5
	2	Online	Ratings	Rating of PCL Study 2a	5
3 ACP	1	Online	Interviews & Sketch	Collect senders for ACP Studies 2 & 3	6
	2	Online	Ratings	Rating of ACP Study 1	6
	3	Online	Ratings	Rating of ACP Study 1	6

Please note, the OSF links to pre-registrations and associated project datasets and R scripts are detailed in each chapter where relevant. A table detailing accuracy rates in the judgement studies can be found in the supplementary materials (Table 30.1; page 147).

Chapter 2: Literature Review

Deception detection theories

Historically, the two most dominant theories of deception detection included emotional/arousal-based deception detection and cognitive based deception detection (Zuckerman et al., 1981). The rationale behind the arousal-based approach is the assumption that lying will lead to physiological responses such as changes in heart and breathing rate (Ben-Shakhar & Elaad, 2003), temperature changes (Warmelink et al., 2011), micro-expressions (Eckman, 2009), and body gestures including hand and leg movements (Vrij & Semin, 1996). Whilst this theory may seem plausible, i.e., if an individual is lying, they may feel under pressure and thus exhibit behavioural responses to this stress (e.g., fidgeting or gaze aversion), there is little empirical support for this notion. This may be due to the Orthello error (Vrij et al., 2010a). In simple terms, the Orthello error occurs when alternative explanations for suspicious/deceptive behaviour are ignored. Failing to take into consideration that a truthful individual may be experiencing levels of stress and subsequent behavioural signs indicative of deception leads to errors in veracity judgements. In more recent years, deception researchers have moved away from emotion/arousal-based lie detection towards more cognitive focussed theories and methods of deception detection.

The cognitive approach to lie detection is an overarching term covering various interview strategies or techniques designed to magnify the differences between truth-tellers and liars. The approach is based on prior observations that lying draws on more cognitive resources than telling the truth (Zuckerman et al., 1981). Therefore, when cognitive load is increased with secondary tasks, liars (already cognitively taxed from fabricating, maintaining and remembering their lie) will reveal more cues to deceit, facilitating deception detection (Vrij, 2015). There are passive and active approaches to cognitive lie detection, with the majority of research falling under the scope of passive approaches (Levine, 2014). Passive approaches assume that natural observable differences will emerge between truthful and deceptive accounts. The most common techniques used to examine truthful and deceptive verbal and written statements include Statement Validity Analysis (SVA; Köhnken, 2004; Volbert & Steller, 2014), Reality Monitoring (RM; Sporer, 2004); SCAN (Nahari et al., 2012); and the Verifiability Approach (VA; Nahari, 2018). Accuracy rates for SVA and RM are around 70% and this high error rate (30%) has led to researchers advising against the use of these techniques in legal settings (Vrij, 2015). The VA has demonstrated higher success rates at distinguishing between truthful and deceptive accounts (up to 88% accuracy; Vrij & Nahari, 2019) in mock crime scenarios (Nahari et al, 2014a; 2014b), insurance settings (Harvey et al., 2017), and airport settings (Jupe et al., 2017). However, the VA has been unsuccessful in non-event settings

such as occupational (Jupe et al., 2016) and malingering settings (Boskovic et al., 2019). For a review of these techniques from an applied perspective see Vrij (2018).

Active approaches to deception detection are based on the premise that investigators/interviewers can actively use interventions to increase the cognitive load of interviewees, in essence making the task more difficult. By adding additional tasks, it is presumed that deceptive interviewees will have fewer cognitive resources available (as they are already experiencing cognitive demands of lying) and this will lead to liars exhibiting cues to deception, thus facilitating lie detection. The three main techniques used in cognitive deception detection approaches include: increasing cognitive load, encouraging interviewees to provide more information, and asking unanticipated questions (Vrij et al., 2017). Techniques used to increase cognitive load include, for example, asking interviewees to give their accounts in reverse order (Vrij et al., 2012); asking interviewees to perform two tasks simultaneously (Debey et al., 2012); asking interviewees to maintain eye contact with the interviewer (Vrij et al., 2010b; and forced turn taking (in group interviews; Vernham et al., 2014). The asking for more information technique rests on the assumption that asking truth-tellers to say more will lead to them providing richer, more detailed and verifiable accounts whereas liars may find it difficult adding details about fabricated accounts and may be concerned that providing too many details will expose their lie. This in turn may lead to them providing less detailed and less plausible accounts (Vrij et al., 2017). Techniques used to encourage participants to provide more information include providing them with a model statement (Leal et al., 2015); using an interviewer with a supportive demeanour (Mann et al., 2013); using the cognitive interview approach (e.g., Colwell et al., 2002; 2007; 2009); and using sketching in interviews (Vrij et al., 2010c; 2020). The asking unanticipated questions technique relies on the preparation and rehearsal that liars undertake in anticipation of questioning (Vrij et al, 2009; Hartwig et al., 2007). This technique can be used in two ways: Firstly, the content of the question can be unanticipated i.e., questions about spatial or temporal details or questions relating to the planning phase of a task or an individual's intentions are considered unexpected (Vrij, 2015). Secondly, the format of the question presentation can be manipulated, e.g., asking people to sketch a response rather than reply verbally is considered unexpected (Vrij, 2015). A meta-analysis on the cognitive load approach (imposing cognitive load, asking participants to provide more information, and asking unanticipated questions) found overall accuracy of truth and lie detection combined to be 71%.

Another active cognitive approach to lie detection is the Strategic Use of Evidence (SUE) technique (Granhag & Hartwig, 2015). This technique takes into account the evidence against the interviewee and uses this evidence in a strategic manner throughout the interview to elicit truthful

and deceptive cues (e.g., consistencies and contradictions between the interviewees' account and the available evidence; Hartwig, Granhag & Luke, 2014). The SUE has been effective in detecting deception about past events (Hartwig et al., 2005) and future intentions (Clemens et al., 2011). The technique is also effective for use with adults (Hartwig et al., 2011), and children (Clemens et al., 2010). See Harwig et al. (2014) for a meta-analysis of the SUE technique.

With some exceptions, the majority of the cognitive approaches to deception detection have examined past lies. Deception detection for future events is still in its infancy in comparison to the literature surrounding past lies. This is surprising given the importance of detecting dangerous and threatening intentions; for example, in suspected terrorist attacks (Vrij et al., 2011b). There are a number of problems with detecting false intentions, such as being unable to establish the 'ground truth'. With past events e.g., crimes, the ground truth can be discovered through various evidential means (e.g., DNA, CCTV footage, witnesses), however intentions have not yet been executed. Despite this, there has been a gradual increase in true and false intention research. This research has followed two approaches; firstly, applying established deception detection techniques about past lies to lies about intentions and secondly, using psychological theory about intentions to develop unique methods and techniques to examine true and false intent (Vrij, 2015).

Techniques for detecting lies about the past used for detecting lies about intentions

A number of techniques used to detect lies about past events have been applied to detecting false intentions. The asking unanticipated questions approach has been used to assess whether differences emerge between truthful and deceptive verbal intentions and has produced mixed findings. Warmelink et al. (2012) found that no differences emerged between liars and truth-tellers' responses to expected questions about their intention, however, liars provided less details than truth-tellers when responding to unexpected questions. Similarly, Sooniste et al. (2013) found that both truth tellers and liars considered questions on planning their intention significantly less anticipated and more difficult to answer than questions about their intention. Truth tellers' answers to questions on planning were longer, richer and clearer than liars' responses, yet both liars and truth teller's answers to questions on intentions were equal for length and detail. Other techniques that have been successful when extended to true and false intentions are the SUE technique (Clemens et al., 2011); the concealed information test (CIT; Meijer et al., 2010; Noordraven & Verschuere, 2013); the autobiographical implicit association test (aIAT; Agosta et al., 2011); and the verifiability approach (VA; Jupe et al., 2017; Nahari et al., 2014; Vrij & Nahari., 2019). Other strands of research have adopted intention specific approaches relating to fields such as goals (Ask et al., 2013); planning (Sooniste et al., 2013), and mental imagery (Knieps et al., 2013a; 2013b). These

approaches assume that the formation of intentions will involve a degree of planning to achieve a particular goal, and these processes may be associated with mental images when constructing future events (Spuznar, 2010). Episodic Future Thought is one area of research that has been applied the study of deceptive intentions, this will be discussed further in the EFT section of this chapter (page 23). Another dominant area of deception detection research has focussed on verbal and nonverbal cues that distinguish truth-tellers from liars and the subjective cues people report to influence their veracity judgements. This area of research will be discussed in more detail below.

Cues to deception

Please note that some of the following section is based on the literature review in O'Connell et al. (2023), which is reproduced in Chapter 5.

Deception research has examined both objective cues and subjective cues to deceit. Objective cues are observable cues related to deceptive behaviour, including verbal (e.g., details and plausibility) and non-verbal (e.g., nervousness and tension; DePaulo et al., 2003). Subjective cues to deception are cues that an observer directs (or believes they are directing) their attention to when making veracity judgements (e.g., gaze aversion, fidgeting, higher voice pitch and speech errors; Caso et al., 2018; Hartwig & Bond, 2011; Wright Whelan et al., 2014). People report using different cues when they believe that the sender is lying compared to when they believe the sender is telling the truth (Bogaard et al., 2016). Cues that people report as influencing their deceptive judgements include low plausibility and low coherence, low perceptual information, fewer unusual details, low cognitive operations, fewer descriptions of emotions, interactions and speech reproductions (Bogaard et al., 2016; Hartwig & Bond, 2011). Cues that influence truthful judgements include more details and repetitions, consistency, fewer contradictions, and fewer omissions (Hudson et al., 2020). However, subjective cues are not always consistent with objective cues to truthful and deceptive behaviour in the literature (Amado et al, 2016; Bond & DePaulo, 2006; Strömwall et al., 2004; Vrij et al., 2011b).

Deception detection research has consistently demonstrated that people are poor lie detectors (Bond & DePaulo, 2006). In fact, across almost 300 studies, almost 90% of lie detection accuracy results were between 40% and 60% (although accuracy rates are increasing, see Levine, 2015). This is also the case for professionals (e.g., police officers, customs officers and secret service agents) whose working environments require the regular detection of deception (57% accuracy; Vrij, 2008). Lie detection accuracy is affected by the modality in which an observer judges a lie (e.g., via video/audio/transcript). Prior research has found people to be less accurate when judging video-only stimuli (Bond & DePaulo, 2006). Several hypotheses have been proposed to explain this modality

effect. The distraction hypothesis posits that the presence of non-verbal cues (i.e., in video stimuli) distracts observers from attending to the verbal content of a message thus increasing the difficulty of identifying truthful verbal indicators (Bauchner et al., 1977; Maier & Thurber, 1968). The information overload hypothesis suggests that the increased cognitive load from processing all incoming information may lead to observers missing important truthful and deceptive cues (Bauchner et al., 1980; Miller et al., 1981; Stiff et al., 1989). Stiff et al. (1989) demonstrated partial support for the situational familiarity hypothesis. This posits that in familiar situations observers use verbal cues only as they are able to assess the validity of the verbal content. In unfamiliar situations, where observers are unable to assess the validity of the verbal cues, they utilise nonverbal cues or cultural expectations (heuristics) in decision making.

In two of the most comprehensive and influential meta-analyses on cues to deception detection to date, DePaulo et al. (2003) and Bond and DePaulo (2006) found that behavioural cues to deception are weak and unreliable, and that people's ability to detect deception is only slightly above chance (54%). Researchers have argued that behavioural differences between truth tellers and liars are so small, judges have minimal diagnostic material to use when judging veracity (Hartwig & Bond, 2011). This has led to a widespread belief in the deception research community that reliable cues to deceit simply do not exist (DePaulo et al, 2003; Volbert & Banse; 2014; Vrij, 2014), and studies that do demonstrate reliable cues to deception may be underpowered or a result of publication bias (Luke, 2019).

In order to understand the consistent low accuracy veracity findings, researchers have explored the processes involved when individuals make credibility judgments (e.g., Levine, 2014). This has led to a shift from research on average lie detection accuracy levels to variance in judge ability and sender believability (see Levine, 2016 for an in-depth discussion). Bond and DePaulo's (2008) meta-analytic findings showed that regardless of the veracity of a message, senders with a truthful and credible demeanour were more likely to be believed. The authors reported that variance in sender demeanour was 10 times larger than any other variant in veracity judgements. Bond and DePaulo suggest that the outcome of a deception judgement depends more on the skill (or lack of skill) of the liar than the acuity of the lie detector. Levine et al. (2011) replicated Bond and DePaulo's (2008) findings with high stakes lies, demonstrating sender variance being 10 or more times greater than variance in judge ability. Furthermore, Levine et al. (2011) found that when veracity and demeanour were matched (e.g., sincere + truthful condition, insincere + deceptive condition), accuracy rates were significantly higher than when veracity and demeanour were mismatched (78.7% and 36.3% respectively). These findings suggest that the most important determinant of lie detection success is the perceived credibility of the sender.

Individual differences in truth-telling and lying ability

Individuals vary in their ability to tell the truth and lie credibly (Bond & DePaulo, 2008; DePaulo & Rosenthal, 1979; Vrij et al., 2010a). Individuals can also appear credible consistently across situations. Bond et al. (2015) found that participants who looked honest also sounded honest and their written transcripts also appeared more honest. This consistency suggests that credible demeanour is trait-like, or dependent on an underlying cognitive skill or process. However, Levine et al. (2011) suggest that although sender demeanour is an individual difference, it may not be completely trait-like i.e., there may be situational variations and trait-by-situation interactions in sender demeanour. Research exploring the underlying traits or cognitive mechanisms involved in credible demeanour is lacking. It is unclear what processes or mechanisms enable an individual to appear honest when lying in different situational contexts and across different mediums. This is surprising given the potential benefits of identifying individuals in which effective lying ability is required for specific job roles (e.g., undercover police officers, politicians, military leaders, lawyers, professional gamblers; Semrad et al., 2020). Of the limited number studies exploring 'good' liars, positive links have been found with certain personality traits e.g., Machiavellianism (DePaulo & Rosenthal, 1979; Geis & Moon, 1981), dominance and high exhibition (Riggio & Friedman, 1983), extraversion and social skills (Riggio et al., 1987a; 1987b) and psychopathy (Billings, 2004). However, other studies have failed to demonstrate such links (e.g., Frank & Ekman, 2004; Wright et al., 2015). Vrij and Granhag (2010) propose certain characteristics that constitute a 'good' liar such as their personality, behaviour, emotions, response to cognitive load and decoding skills. The authors suggest that good liars will not experience feelings of guilt and fear, and this is related to their confidence and greater experience in lying. They propose that in high stakes situations where good liars do experience feelings of fear, they are better able to mask or camouflage these emotions. Additionally, Vrij and Granhag (2010) argue that good liars will experience lying behaviour as less cognitively demanding i.e., they will be more prepared and provide less verifiable information. They suggest that good liars will be original, eloquent, quick thinking, have good memory and will monitor the behaviour of the receiver: if the receiver becomes suspicious a good liar will adjust their responses. According to Vrij and Granhag (2010), some individuals exhibit suspicious behaviour whereas others display behavioural patterns associated with honesty and likeability. Taken together, this suggests that there may be individual differences in cognitive processing skills that some individuals possess to a greater extent or perform quicker than others.

The cognitive processes involved in lying ability have been explored and processes such as inhibitory control, task switching and working memory have been shown to be important

contributors for successively lying about current or past events (Atkinson, 2019). Maldonado et al. (2018) found that when lying, individuals with low working memory capacity (vs. high working memory capacity) had greater difficulty remembering the truth and were more easily detected as liars. Briazu et al. (2017) found that individuals with greater counter factual thinking ability generated more lies, than individuals who think less counterfactually. Lying ability has also been linked to self-awareness i.e., individuals with higher private self-awareness are more successful liars than those with lower private self-awareness (Johnson et al., 2005). Taken together, these findings indicate that lying about present or past events draws on various cognitive processes and it is likely that these processes are also important for lying about intentions. However, lying about intentions may involve additional cognitive processes related to future thinking. This thesis proposes that individual differences in sender credibility may be related to Episodic Future Thought (EFT) when telling the truth and lying about intentions.

Episodic Future Thought

Episodic future thinking (EFT) refers to the ability to simulate mental events that may occur in an individuals' personal future (Szpunar, 2010). EFT involves pre-experiencing future events such as imagining being in specific future situations such as picturing the setting, people and the action in our mind (D'Argembeau & Van der Linden, 2004). Mentally pre-experiencing future even12ts can occur in a variety of ways and usually on a daily basis (e.g., what you are going to eat for lunch; your plans for the weekend; your next holiday). In an attempt to organise the vast array of ways that individuals think about the future, Szpunar et al. (2014) use the concept of prospective cognition to propose 4 interactive categories of future thinking: Simulation (the mental construction of a detailed depiction of the future); prediction (approximation of the probability and/or reaction to a future outcome); intention (mentally setting a goal); and planning (identifying and organising actions to achieve a goal). Whilst episodic future thinking could potentially fall under all of these categories, almost all studies involving EFT focus on episodic simulation (Schacter et al., 2017).

Tulving (2002) suggested that EFT depends on episodic memory (EM) i.e., the ability to recollect past personal experiences. This link between EM and EFT has been demonstrated in clinical studies whereby patients displayed deficits in EM and EFT (Addis et al., 2009; Klein et al., 2002; Rosenbaum et al., 2009). Schacter and Addis (2007) proposed the constructive episodic simulation hypothesis in which EM provides the constructive processes to retrieve and recombine stored episodic details into a novel episode. This hypothesis has been supported by neuro-imaging studies in which overlapping neural areas are engaged during EM and EFT. These areas have been described

as the 'core network' and include the medial temporal and frontal lobes, posterior cingulate and retrosplenial cortex as well as the lateral parietal and temporal areas (Schacter et al, 2012; Benoit & Schacter, 2015). Not only has the link between EM and EFT been widely accepted for a number of years, some researchers have suggested that the main and most important adaptive function of long-term episodic memory is to use stored information for planning the future (Klein et al., 2010). To demonstrate the adaptive function of long-term memory in supporting future thinking, Klein et al, (2010) asked participants to recall a list of words in which the encoding tasks varied in temporal perspective (future-oriented planning, past-oriented, atemporal, or survival processing). Consistent with their hypothesis, the authors found that future-oriented planning resulted in the most superior recall and thus support another possible function of episodic memory – the ability to mentally travel back to personal past events, but also to envisage and plan for personal future events. Recently Addis (2018) revised the earlier proposition of the constructive episodic simulation hypothesis. Addis suggests that rather than future thinking processes relying on episodic memory (EM), both EM and EFT are inherently part of the same process i.e., constructive episodic simulation. Drawing on perspectives from philosophy, cognitive neuroscience and psychology, Addis suggests that although EM and EFT contain some differences e.g., temporal direction, content and/or phenomenological characteristics, such differences are superficial, memories and imaginings rely on the same neural network and involve the same constructive activation, integration and encoding processes.

However, the idea that EFT fits into an exclusively episodic model has been challenged conceptually, empirically and phenomenologically (Klein, 2016). Klein (2016) argues that autonoesis or autonoetic consciousness (i.e., an individual's awareness of their self as an entity in time) rather than episodic memory per se, is the causal factor that allows individuals to mentally project themselves into a personal future. Other research has focussed on the importance of semantic memory (SM) in future-oriented mental time travel (e.g., Abraham et al., 2008; Anderson, 2012; Klein et al., 2002). In light of the increased evidence of the important role SM plays in future-oriented mental time travel, Irish et al. (2012) propose the semantic scaffolding hypothesis whereby semantic knowledge provides the necessary scaffolding required to facilitate EFT. Similar to the constructive episodic simulation hypothesis, the semantic scaffolding hypothesis has been supported by neuroimaging studies which show that thinking about the future versus the past in personal and non-personal contexts involved significant use of semantic processing regions (the inferior temporal gyrus and the temporal poles; Abraham et al., 2008). Whilst a critical review of the contributions SM and EM offer in future oriented thinking is beyond the scope of this thesis, it is worth noting that there is now a shift in viewing these two types of memory as dissociable systems to a more complex interactive relationship involved in past and future thinking.

Other researchers have suggested the ability to imagine future events involves various component processes such as working memory (Suddendorf & Corballis, 2007; Hill & Emery, 2013), executive functioning (D'Argembeau et al, 2010), and scene construction (Hassisbis & Macguire, 2007; 2009). The majority of this research has considered EFT as a constructive process, however Cole and Kvavilashvili (2021) recently propose a dual process account that takes into consideration spontaneous future thoughts. The authors propose two routes in which episodic future thoughts are created, involving related but different cognitive processes. One route is voluntary and involves slow, deliberate constructions of future scenarios, the second route involves spontaneous and automatic processes, in which episodic thoughts rapidly come to mind following internal and external cues. The involvement of automatic and spontaneous episodic future thoughts makes sense from a functional perspective i.e., it would not be efficient to always use deliberate and effortful future thinking. In fact, Cole and Kvavilashvili (2021) suggest that automatic spontaneous future thoughts may be the default process when imagining the future.

The functioning benefits of EFT have been demonstrated in tasks such as decision making, problem solving, emotion regulation (e.g., coping), goal processing, implementation intentions, and planning (Schacter et al, 2017; Spuznar, 2010). Studies on obesity and eating behaviour have shown EFT to enable improved dietary decision making (Sze et al., 2017; Dassen et al., 2016). EFT has also been shown to affect decision making in alcohol (Snider et al., 2016) and smoking consumption (Stein et al., 2016). EFT specific techniques (e.g., episodic specificity induction; Jing et al., 2016) have been shown to improve emotional regulation. Conversely, techniques used to supress fearful future simulations have been effective at reducing feelings of apprehension towards feared imagined scenarios (Benoit et al., 2016). Positive effects of EFT have also been found in goal processing such as higher exam performance (Taylor et al., 1998), and reduced delayed discounting in financial goals (O'Donnell et al., 2017), and cheating behaviour (Wu et al., 2017). EFT has also been shown to positively influence intention formation and planning, i.e., the simulation of an intention increases the likelihood of the intention being executed (Altgassen et al., 2015; Neroni et al., 2014).

Prior research has demonstrated individual differences in the ability to construct detailed mental representations when imagining future events i.e., individuals with higher visual imagery ability experienced more visual, sensory and spatial details while representing future events (D'Argembeau & Van der Linden, 2006). Furthermore, individual differences in executive functioning predicts the quantity and quality of episodic details given about specific future events (D'Argembeau et al., 2010; Hill & Emery, 2013).

Granhag and Knieps (2011) were the first researchers to apply the theory of EFT to explore how the formation of true and false intentions may differ. Granhag and Knieps posited that the processes involved in the creation of a lie will be governed by information management (i.e., in anticipation of interview questions and the preparation of answers in response to these interview questions), whereas truthful participants will talk freely about their intentions. Thus, deceptive participants creating a lie will not evoke EFT to the extent that truthful participants will when planning true intentions. Supporting this hypothesis, in their experimental mock crime set-up, Granhag and Knieps (2011) found that truth-tellers reported evoking a mental image to a greater extent (97%) than liars (66 %), indicating that truth-tellers might be engaging in EFT more than liars. Truth-tellers also provided richer verbal descriptions of their mental image than liars. Later, Knieps et al. (2013a) and Knieps et al. (2013b) replicated Granhag and Knieps (2011) findings of truth-tellers evoking a mental image to a greater extent than liars. Whilst these results suggest that EFT may be involved in telling the truth and lying about intentions, it is not clear whether there are individual differences in engagement with EFT and if this extends to the credibility of the sender. In order to test this, a separate group of participants is required to judge the veracity and credibility of accounts provided by individuals with varying levels of EFT ability. This formed the basis for the first study in Chapter 4 of this thesis. Using an individual differences approach, we assessed whether EFT ability affected credibility when telling the truth and lying about intentions. Upon finding a positive relationship between EFT ability and credibility in Chapter 4, we sought to explore the subjective cues that may be influencing credibility judgements of high vs. low EFT individuals (Chapter 5). Finally, in Chapter 6, we explored whether the EFT ability and credibility relationship is found when the truth or lie being told is temporally different i.e., when participants describe a current event rather than a future event (as in Chapter 4).

Chapter 3: Episodic Future Thinking Tasks

Many of the first episodic future thinking measures were designed and used in clinical and neuroimaging studies (e.g., Addis et al., 2007; 2008; Hassibis et al., 2007; MacLeod et al., 1993; Williams et al., 1996). More recently these measures have been used more broadly in areas such as individual differences in future thinking (D'Argembeau and Van der Linden, 2006; D'Argembeau et al., 2010); decision making (e.g., relating to dietary choices, alcohol and smoking consumption; Dassen et al., 2016; Snider et al., 2016; Stein et al., 2016; Sze et al., 2017); emotional regulation (Jing et al., 2016; Benoit et al., 2016); goal processing (Taylor et al., 1998); reduced delayed discounting (O'Donnell et al., 2017); intention formation and planning (Altgassen et al., 2015; Gaesser & Schacter, 2014; Neroni et al., 2014).

Future thinking measures can be divided into two broad categories: content measures and generation measures (Miloyan & McFarlane, 2019). Content measures are used to assess phenomenological characteristics, episodic richness and episodic specificity of future thought and can further be divided into two more subcategories: examinations (objective observer ratings whereby the researcher scores or codes participants responses) and phenomenological assessment (subjective self-report ratings made by the individual imagining the future event; Miloyan & McFarlane, 2019). Questions relating to phenomenological characteristics are often derived from various memory characteristics questionnaires, for example, the Autobiographical Memory Questionnaire, the Memory Characteristics Questionnaire (MCQ; Johnson et al., 1988), and the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973). Phenomenological characteristics can include ratings of vividness, spatial details, valence, sensory details, temporal details, familiarity and are usually self-reported on Likert scales. Generation measures include measures that are used to assess participants simulated future events such as during fluency tasks (e.g., sentence completion tasks, reaction times, and thought sampling; Miloyan & McFarlane, 2019). Future fluency tasks assess the ease at which participants can think of and report episodic future thoughts e.g., the Future Thinking Test (MacLeod et al., 1998; later adapted by D'Argembeau et al., 2010 and named the Autobiographical Fluency Task), the Explanations Task (Byrne & MacLeod, 1997), and the Verbal Autobiographical Fluency Task (VAF; Coste et al., 2015). Reaction time tasks measure the amount of time participants take to recall or imagine specific past or future events in response to various cue words (e.g., D'Argembeau & Van der Linden, 2004). Sentence completion tasks (e.g., the Sentence Completion Test for Events in the Future; Anderson & Dewhurst, 2009) are used to assess the specificity of the generation of past and future events. Thought sampling explores voluntary and/or involuntary future thoughts over a period of time (usually in naturalistic rather than laboratory settings).

Examples of the tasks used in examination and generation measures from the literature will be discussed in more detail below. Whilst these measures are described individually, it should be noted that many studies in the literature use multiple measures e.g., in D'Argembeau et al.'s (2010) study, participants were required to complete four tasks measuring different aspects of future thinking (episodic details, episodic specificity, episodic fluency, and phenomenological characteristics) as well as a variety of tasks measuring different component processes thought to support future thinking (e.g., visual-spatial processing and executive processing).

Examinations

Autobiographical Interview

Originally developed by Levine et al., (2002), the autobiographical interview was used to assess autobiographical memory of younger and older adults using text-based analyses of transcribed autobiographical tasks. It was later adapted by Addis et al. (2008) to measure episodic future thinking and episodic memory. In the adapted AI, participants are required to generate past and future events in response to cue words (e.g., table, beach) and time periods (e.g., 1 week, 1 year). Participants are given a time limit to verbally describe their event (relating to the cue word/time period; lasting minutes or hours but not more than a day) and are asked to describe the event verbally in as much detail as possible. Responses are coded for internal details (event, time, place, perceptual, emotion/thought) and external details (semantic, external episodic, external generic, repetition, and other).

Episodic Specificity

Episodic specificity tasks measure the ability to construct specific episodic events (i.e., time and place). Most specificity tasks are also measured via responses to cue words, however, unlike the autobiographical interview whereby responses are coded for individual details (e.g., perceptual and temporal), responses are scored on the overall specificity of the described event for example on a 3-point rating scale: general (1 point), intermediate (2 points), and specific (3 points; Williams et al., 1996). Responses are scored as general if they do not contain specific details; intermediate responses include routine or repeated events, and events that last more than 24 hours. Specific responses include autobiographical details, unique information, contextual details (such as places and names) and describe events that last less than 24 hours. Scoring includes the total number of specific responses to each cue word. Table 2.1 below shows examples of responses for each of the 3 categories from Williams et al. (1996).

Table 2.1

Examples of general, intermediate and specific responses from Williams et al. (1996).

Try and picture a situation in the future where, (a) 'you make a mistake'		
General: 'I'll always be making mistakes'	**Intermediate:** 'Perhaps giving a friend the wrong advice.'	**Specific:** 'My law exams in October.'
Try and picture a situation in the future where, (b) 'someone pays you a compliment'		
General: 'A friend could'	**Intermediate:** 'Someone at work my say I've lost weight'.	**Specific:** 'Next week from my husband when I have my hair cut again'.

Experiential Index

Originally developed by Hassabis et al. (2007) and later adapted by D'Argembeau et al., (2010) and named the Episodic Details Task), the Experiential Index was designed to measure the richness of imagined events. Participants are requested to imagine a given scenario and describe this in as much detail as possible. Participants responses are recorded, transcribed, and broken down into a set of statements. In the original version, scoring is derived from 4 subcomponents: content, sense of presence and vividness, spatial coherence, and the overall quality of the described event, producing a final score between 0 (not experienced at all) and 60 (extremely richly experienced). The first component relates to the content of the imagined event and is coded similarly to the AI: spatial, entity, sensory, thought/emotion/action categories. The maximum score for each category is 7, therefore maximum scores for content are 28. Later D'Argembeau et al (2010) added an extra category: temporal, therefore increasing maximum content scores to 35. The second component (sense of presence and vividness) are scored on two 5-point scales. Spatial coherence includes 12 statements relating to the construction of the imagined event (e.g., 'I could see the whole scene in my mind's eye'), participants select as many statements as they wish. The overall quality of the imagined event involves the researcher rating the extent to which the event evoked a feeling of experiencing for the researcher on an 11-point scale from 0(no picture at all) to 10(extremely rich, vivid picture).

Thematic Content

Thematic content of imagined future events have been analysed qualitatively and quantitatively (Miloyan & McFarlane, 2019). D'Argembeau et al. (2006) asked participants to remember seven specific past events and imagine seven specific future events for different time

periods (today, yesterday/tomorrow, one week ago/in one week, one month ago/in one month, one year ago/in one year, five years ago/in five years, ten years ago/in ten years). Events were categorised as relating to school/work, parties, childbirth/episodes with children, leisure activities, romantic episodes, conversations with friend/relative, travel episodes, accidents/illness, moving, and shopping. Other studies have categorised future events using cultural life scripts (e.g., Rubin, Berntsen & Hutson, 2009).

Linguistic Analysis

Linguistic analysis has been used to assess the quantity or various features of speech in future thinking. Areas of exploration have included pronoun use (e.g., first person, third person and plural) in self-referential processing (Bertossi et al., 2016). Race et al. (2015) examined discourse coherence and cohesion of past and future events (e.g., winning the lottery in the future and recalling a past graduation ceremony). Cohesion was scored based on the cohesive ties present across participants' phrases, cohesive ties included references, ellipses, lexical cohesions, substitutions, and conjunctions. Coherence was measured across three dimensions (context, chronology, and theme) on a four-point rating scale. Other areas of linguistic analysis have focussed on spatial details (Cole et al., 2013); temporal details (Lind et al., 2014), and time orientation (Fillmore et al., 2021).

Generation measures

Fluency

Future fluency tasks assess the ease at which participants can think of and report episodic future thoughts. Originally developed to assess the ease at which parasuicide individuals think about positive and negative future events (MacLeod et al., 1993), the task requires participants to think of and report as many examples of things they were looking forward to/not looking forward to over five time periods: the next 24 hours, the next week, the next month, the next year, and the next 10 years. Participants are given 30 seconds to report as many events as possible. The future fluency task has since been adapted into the Autobiographical Fluency Task (D'Argembeau et al., 2010) and events to be reported include plausible future events from these five time periods. The length of time to report these events in each time period varies across studies (30 seconds/one minute/3 minutes; Miloyan & McFarlane, 2019).

Sentence Completion

Sentence completion tasks involve the presentation of a partial sentence stem in which participants are required to complete the sentence with words or phrases. Sentence completion tasks aim to assess the specificity/generality of future thinking. Anderson and Dewhurst (2009) used the Sentence Completion Test for Events in the Future (SCEFT; adapted from the Sentence Completion Test for Events from the Past; SCEPT) which requires participants to complete 11 sentence stems relating to future events (e.g., 'when I look forward to'). Participants are given six minutes to complete as many sentence stems as they possibly can. Responses are coded as: specific, categoric, extended, semantic, omission.

Reaction Time

Reaction time tasks measure the amount of time participants take to recall or imagine specific past or future events in response to various cue words. A cue word is presented on a computer screen and participants are required to press a key when a specific event comes to mind. Reaction time tasks are commonly used alongside other EFT measures (Miloyan & McFarlane, 2019), for instance, D'Argembeau and Van der Linden (2004) combined a reaction time test with a descriptive task and a phenomenological task.

Thought Sampling

Thought sampling involves measures of various aspects future thinking in naturalistic rather than laboratory settings. Thought sampling tasks can involve the recording of involuntary future thoughts or voluntary future thoughts generated in response to cue words (Miloyan & McFarlane, 2019). Participants record future-oriented thoughts (e.g., over the course of one day), describing the content of future-oriented thoughts and rating the characteristics and functions of each thought (e.g., temporal details, phenomenological characteristics; Berntsen & Jacobsen, 2008; D'Argembeau et al., 2011).

Current Study

The focus of this thesis is how Episodic Future Thinking ability affects truth and lie telling ability. The aim in the current study was to use a variety of EFT measures to determine which single EFT task is the most valid measure to use in subsequent studies throughout the thesis. It was decided to test a mixture of five examination and generation measures covering specificity, fluency, episodic details and phenomenology. Four of the tasks were adapted from D'Argembeau et al. (2010). As the first study in this thesis explored whether truth-tellers reported evoking a mental image to a greater extent than liars (as found in Granhag & Knieps, 2011), we decided to also use an additional future thinking task, the Vividness of Visual Imagery Questionnaire (Marks, 1973) – a self-

report measure used to assess the clarity of individual's visual imagery. This resulted in five EFT tasks: an Episodic Details Task (EDT) which also included a Memory Characteristics Questionnaire (MCQ; to assess phenomenology), an Autobiographical Specificity Task (AST), an Autobiographical Fluency Task (AFT), and a Vividness of Visual Imagery Task (VVIQ). Below I describe each of the EFT tasks used in the first study of this thesis, the procedure and the analyses that informed the decision to proceed with one EFT task for the subsequent studies in this thesis.

Overview of Study 1a

Participants

We conducted a priori power analysis (using G*power): alpha was set at 0.05 and power was set at 0.95. The power analysis assumed two tailed, a H0 of 0, H1 variance explained of 0.2, 5 predictors (the various EFT measures) and a small effect size of 0.2. This analysis suggested 102 participants would be needed. 104 participants (75 women, 29 men; M_{age} = 20.25 years, *SD*=2.95) were recruited via the University's research participation system. 72 participants earned 2 course credits for participation; the remaining 32 participants were paid £7 each for taking part. See supplementary materials for analyses of the differences between these two groups.

Design

A 2(Veracity: Truthful vs. deceptive) x 3 (Order of tasks: 1 vs. 2 vs. 3) mixed design was used. Veracity was the within-subjects factor and the order of tasks was the between-subjects factor. Participants were randomly assigned to one level of the between-subjects factor. The dependent variables were the number of details and words participants used in their truthful and deceptive intentions task descriptions and mental image descriptions; the reporting of the activation of mental image; and participant's EFT ratings in the post-interview questionnaire.

Materials

In accordance with the pre-registration (https://osf.io/bpkf3/?view_only=b6a8b30866fb4cae85bfa31f6b5c8e5b), participants EFT ability was measured using five future thinking tasks adapted from D'Argembeau et al. (2010): An episodic details task (EDT) combined with a Memory Characteristics Questionnaire (MCQ; Johnson et al., 1988); an Autobiographical Fluency Task (AFT), and an Autobiographical Specificity Task (AST), and the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973). Each of these future thinking tasks are outlined below.

Episodic Details Task (EDT)

The EDT (D'Argembeau et al., 2010) examined two measures: firstly, the number of episodic details participants were able to imagine/generate when they had a specific future event in mind, and secondly the ratings of the phenomenological characteristics of the event. Participants were asked to imagine a possible situation that they may encounter in the future. This was a specific situation (something they will do on their next holiday), and participants were asked to report aloud as much detail as possible about the event including where they were, who they were with, what is around them and any other details they could formulate. Immediately after this task, participants were asked to complete a series of questions adapted from the Memory Characteristics Questionnaire (MCQ, Johnson et al., 1988) indicating their phenomenological experience of the event. Participants rated their answers on a scale; for example, clarity of location (1= vague, 7= very clear); smell/taste (1= little, 7= a lot); visual details (1= little, 7= a lot). D'Argembeau et al. (2010) demonstrated good and excellent reliability for each of the coding categories for the EDT: temporal details (*ICC*=.93); spatial details (*ICC*=.93); physical entities (*ICC*=.92); sensory details (*ICC*=.93); thoughts/emotions/actions (*ICC*=.75).

Autobiographical Fluency Task (AFT)

The AFT (D'Argembeau et al., 2010) examined participant's ability to access/generate generic representations of future events for specific time points. Participants were asked to think of as many future events as possible in one minute for 3 different time periods (given verbally one at a time in order): "the next week, including today", "the next year" and "the next 5 years". D'Argembeau et al. (2010) reported good reliability for the AFT (*ICC*=.85).

Autobiographical Specificity Task (AST)

The AST (D'Argembeau et al., 2010) examined participants' ability to access/construct specific future events via a cue-response exercise. Participants were presented with a series of cue words (see supplementary materials – Page 44) with varying levels of imaginability and were advised to generate a specific future event (important/unimportant which occurs in a specific place at a specific time and should last minutes or hours but not more than a day). Two sets of 5 cue words were used (A and B) and each set of words was matched for imageability (*M*=5.03 vs. 5.02; on a 7 point Likert scale with from 1: low in imagery to 7: high in imagery; Desrochers & Bergeron, 2000), length (*M*= 6.2 vs. 6.2 letters), and frequency of use (*M*= 51.74 vs. 51.44 per million of occurrence; New et al., 2004). The researcher read aloud one set of 5 cue words to each participant. Participants were given 30 seconds to imagine and report a specific event in response to each individual cue. The

order of the 2 lists was counterbalanced across participants. D'Argembeau et al. (2010) demonstrated excellent reliability for the AST (*ICC*=.93).

Phenomenological Tasks: Vividness of Visual Imagery Questionnaire (VVIQ) and Memory Characteristics Questionnaire (MCQ)

The VVIQ (Marks, 1973) is a self-report measure used to assess the clarity of individual's visual imagery. The questionnaire consisted of 16 statements which participants formed a mental image of, then rated these on a 5-point-scale of vividness, with a higher number indicating higher vividness. As suggested by McKelvie (1995), this was reversed from the original numerical scale in which higher numbers represented less vividness. As per the imagery questionnaire instructions (Marks, 1973), participants completed the task once with their eyes open and once with their eyes closed (in a counter balanced order). In the eyes closed condition, participants were provided with a blindfold and listened to the questionnaire instructions on a standardised pre-recording via a laptop. The researcher recorded the participant's verbal rating for each question. The VVIQ has been found to have high reliability and validity (ICC=.96; Rossi, 1977; also see Richardson, 1994; McKelvie, 1995). Factor analysis in various studies have also reported Cronbach's α of .88 (Burton, 2003); .95 (Burton & Fogarty (2003); .91 (Campos & Pérez-Fabello, 2009). Participants also completed a MCQ via three surveys which were completed after the EDT, the truthful interview, and the deceptive interview to indicate participants' phenomenological experience of the event (the holiday experience described in the EDT and the most dominant mental image formed when participants were planning their truthful and deceptive tasks). These questions included for example, imagination of the event (1=Dim, 7=sharp/clear); the amount of visual details involved in the event (1=few/none, 7=many); clarity of location (1= vague, 7= very clear); smell/taste (1= little, 7= a lot); visual details (1= little, 7= a lot); time of the event (1=vague, 7=clear/distinct); emotions (1=negative, 7=positive); feelings of pre-experiencing the event (1=not at all, 7=a lot).

Procedure

Ethical approval for the current study was obtained from Lancaster University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants arrived at the laboratory, read a participant information sheet, and then provided written consent to take part. The procedure was based on a similar experimental set up to Granhag and Knieps (2011). Participants were randomly assigned to 1 of 3 groups which determined the order of the tasks, see Table 3.1 below:

Table 3.1
Order of task presentation

Order 1	Order 2	Order 3
EDT and *MCQ*	**VVIQ**	**AST**
First intention planning task	First intention planning task	First intention planning task
Interview 1 and *post interview questionnaire*	Interview 1 and *post interview questionnaire*	Interview 1 and *post interview questionnaire*
AFT	**EDT** and *MCQ*	**VVIQ**
AST	**AST**	**AFT**
Second intention planning task	Second intention planning task	Second intention planning task
Interview 2 and *post interview questionnaire*	Interview 2 and *post interview questionnaire*	Interview 2 and *post interview questionnaire*
VVIQ	**AFT**	**EDT** and *MCQ*

Future thinking tasks in **bold; phenomenological tasks in italics*

Each participant completed all future thinking tasks, a truthful planning task and a deceptive planning task (in one of the three orders from Table 3.1). After each planning task and before carrying out their task (truthful and deceptive), participants were intercepted and interviewed about their plans. During the interview participants were asked to describe their plans and describe their most dominant mental image that came to mind when planning their task. Following each interview, participants completed a post interview questionnaire which included a series of questions adapted from the MCQ (Johnson et al., 1988), indicating their phenomenological experience of the planned event. See Study 1 on page 50 for the full study procedure and supplementary materials for planning tasks (page 71) and post interview questionnaires (page 74).

Future thinking tasks coding and scoring

Episodic Details Task

Responses to the EDT were transcribed verbatim. As in D'Argembeau et al. (2010), each response was broken down into a set of statements and coded based on the categories spatial, entity, sensory, thought/emotion/action and temporal. Responses that described a past event were not coded, nor were any events mentioned that lasted more than 24 hours. In D'Argembeau et al. (2010), the scoring for the ETD was capped for each content category to a maximum score of 7 then added the sum score of each of the 5 categories to give an overall total score for each participant, i.e., a maximum of 35). However, as the focus of this thesis is exploring individual differences in EFT ability, we did not cap scoring for content categories.

Autobiographical Fluency Task

Events in each time period (the next week, including today, the next year, and the next 5 years) were counted and a combined to give an overall score for each participant. Events repeated across time periods were not counted nor were general descriptions (e.g., 'I hope I will be happy').

Autobiographical Specificity Task

Scoring for the AST was based on a system used by Williams, Ellis, Tyers and Healy, (1996). Participants' responses were rated for level of specificity (general – 1 point, intermediate – 2 points, and specific – 3 points). This was based on the level of detail provided, such as references to specific times and places and whether people's names were used. Williams et al. (1996), provide 2 examples of general, intermediate and specific responses (see Table 2.1). Scoring the AST involved the total number of specific responses to each cue word.

Inter-rater reliability

One coder rated 100% and another coder rated 25% of the responses in the EDT, AFT, and AST. A two-way random, absolute agreement, average measures Intraclass Correlation Coefficient (ICC) analysis was conducted to examine the two coders level of agreement. As shown in Table 4.1, the inter-rater reliability was excellent for all three tasks.

Table 4.1

ICC for the EDT, AFT and AST.

Task	ICC	95% CI
EDT	.962	.917, .983
AFT	.970	.933, .987
AST	.940	.867, .973

Table 4.2 shows the ICC for the individual coding classification for the EDT task. As shown in the table, the inter-rater reliability was excellent for the spatial, entity, sensory and thought/emotion/action category and good for the temporal category.

Table 4.2

ICC for individual perceptual categories of the EDT

Task	Perceptual Category	ICC	95% CI
EDT	Spatial	.967	.854, .985

Entity	.971	.929, .989
Sensory	.951	.877, .980
Thought/Emotion/Action	.966	.832, .984
Temporal	.838	.407, .923

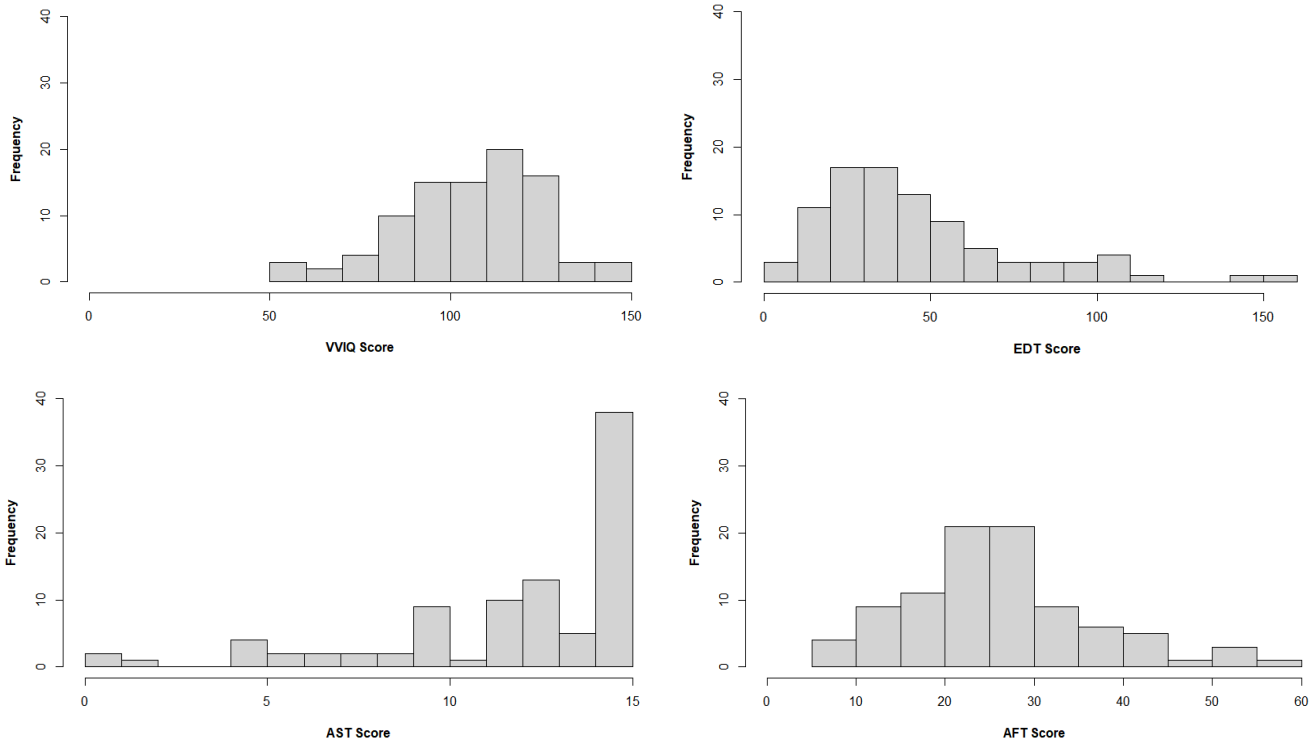
Data Analysis

Pearson Correlation was conducted to examine the relationship between responses on the EDT, AST, AFT, and VVIQ. Spearman rho correlation was conducted to test the relationship between responses across all phenomenological tasks: VVIQ; MCQ; and perceptual details of participants' most dominant truthful and deceptive mental image. An exploratory Principal components analysis on the four EFT tasks with oblimin rotation was conducted to assess whether the number of future thinking tasks could be reduced for subsequent studies in the thesis. Linear regressions were used to examine whether each of the future thinking tasks predicted the number of details and number of words participants used when describing their truthful and deception mental image and their truthful and deceptive planning task. All statistical tests were 2-tailed.

Results

Distribution

Figure 2.1 shows histograms of the distribution of participants' scores on the VVIQ, EDT, AST, and AFT.



Correlation between future thinking tasks

Table 5.1 shows the results of the Pearson Correlation of the VVIQ, AFT, EDT, and AST. As shown in Table 5.1, the AFT, AST, and EDT significantly correlated whereas the VVIQ did not correlate with any of the other future thinking tasks.

Table 5.1

Pearson Correlation for the VVIQ, AFT, EDT and AST (N=103)

	VVIQ	AFT	EDT	AST
VVIQ	.	.057	.037	-.022
AFT	.057	.	.292	.232*
EDT	.037	.292**	.	.237*
AST	-.022	.232*	.237*	.

**p <.05. **p <.01.*

Correlation between phenomenological tasks

The results of the Spearman rho correlation are shown in Table 5.2. As shown in the table, all tasks significantly correlated. The strongest correlated relationship was in participants' ratings of their truthful and deceptive most dominant mental image formed whilst planning their intentions.

Table 5.2

Spearman rho correlation table for VVIQ, Truthful and Deceptive Mental Image and MCQ

	VVIQ	Truthful Mental Image	Deceptive Mental Image	MCQ
VVIQ	.	.370**	.289**	.284**
Truthful Mental Image	.370**	.	.401**	.286**
Deceptive Mental Image	.289**	.401**	.	.241*
MCQ	.284**	.286**	.241*	.

**p <.05. **p <.01.*

Principle Component Analysis

The Kaiser-Meyer-Olkin measure (.60) and Barlett's Test of Sphericity (.006) verified the sampling adequacy for the analysis (Field, 2013). An initial analysis was run to obtain eigenvalues for

each factor in the data. Two factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 63.04% of the variance. The scree plot suggested that a one or two component solution may be viable (eigenvalues for the components were 1.51, 1.01, .77, .71). Three items loaded heavily on component 1 (EDT - .73, AFT - .72, and AST - .68), and one item loaded heavily on component 2(VVIQ - .98).

Future thinking tasks relation to truthful and deceptive tasks

The results of the linear regressions which examined whether each of the future thinking tasks (EDT, AST, AFT and VVIQ) predicted the number of details and number of words participants used when describing their truthful and deception mental image and their truthful and deceptive planning task are shown in Table 6.1.

Table 6.1

Regression analyses for EFT tasks predicting details and word count for mental image description and planning task description

		B	*SE*	95% *CI*	*p*
Truthful Mental Image Details	EDT	.29***	.07	.15, .42	<.001
	VVIQ	.24*	.10	.04, .44	.021
	AFT	.19	.20	-.20, .58	.335
	AST	1.23*	.54	.15, 2.30	.026
Truthful Mental Image Word Count	EDT	.61***	.17	.30, .93	<.001
	VVIQ	.49*	.24	.01, .97	.045
	AFT	.69	.47	-.24, 1.62	.145
	AST	3.11*	1.29	.55, 5.68	.018
Deceptive Mental Image Details	EDT	.23***	.06	.11, .35	<.001
	VVIQ	.07	.09	-.11, .25	.418
	AFT	.01	.18	-.35, .37	.952
	AST	1.59*	.50	.58, 2.58	.002
Deceptive Mental Image Word Count	EDT	.54***	.13	.27, .80	<.001
	VVIQ	.16	.20	-.23, .55	.405
	AFT	-.07	.39	-.86, .71	.851

	AST	3.66**	1 .09	1.49, 5.83	.001
Truthful Planning Task Details	EDT	.23*	.09	.06, .41	.010
	VVIQ	.10	.13	-.15, .36	.419
	AFT	.01	.25	-.48, .51	.954
	AST	1.82*	.73	.38, 3.27	.014
Truthful Planning Task Word Count	EDT	.55**	.17	.21, .89	.002
	VVIQ	.16	.25	-.33, .65	.525
	AFT	-.03	.48	-.99, .93	.947
	AST	3.46*	1.41	.66, 6.26	.016
Deceptive Planning Task Details	EDT	.15*	.05	.04, .25	.006
	VVIQ	-.07	.08	-.22, .08	.326
	AFT	.19	.15	-.10, .48	.191
	AST	.60	.43	-.24, 1.48	.161
Deceptive Planning Task Word Count	EDT	.30**	.09	.11, .48	.002
	VVIQ	- .09	.14	-.36, .18	.504
	AFT	.32	.27	-.21, .85	.230
	AST	1.05	.78	-.50, 2.59	.181

*** $p<.001$, ** $p<.005$, * $p<.01$

As shown in Table 6.1, the EDT predicted the number of words and number of details participants used in their mental image descriptions and their planning task descriptions (in both veracity conditions). The AST predicted the number of details participants used when describing their truthful and deceptive mental image and their truthful (but not deceptive) planning task. The AST also predicted the number of words in participants statements in their truthful and deceptive mental image and their truthful (but not deceptive) planning task. The AFT did not predict the number of details and words used in any of the participants statements. The VVIQ predicted the amount of detail and words used in participants description of their truthful mental image only.

Discussion

The Correlations and Principal Component Analysis indicated that the VVIQ was measuring a different EFT concept to the EDT, AFT and AST. This could be due to the modality i.e., the VVIQ is a self-report rating task whereas the other three tasks included verbal responses and observer coding. As the deception task also involved verbal responses, it was decided to remove this as a measure for EFT in subsequent studies in this thesis. Due to the abnormal distribution and large ceiling effect of

the AST (left-skewed – see Figure 2.1), we decided this was not a suitable measure to carry forward in the subsequent studies. The AFT did not relate to participants performance (i.e., verbal statements) when describing their truthful and deceptive mental images and their truthful and deceptive planning tasks, therefore this measure was also considered unsuitable for use in the follow up studies. Therefore, it was decided that the EDT was the most suitable measure to proceed with for the remaining studies in the thesis.

Episodic Future Thinking involves multiple features or components (Schacter et al., 2017; Szpunar et al, 2014). In the current study we assessed four components: fluency, specificity, episodic details, and phenomenology. Prior studies that have used multiple measures to assess different aspects of EFT have failed to demonstrate strong correlations between EFT measures, thus suggesting distinct areas of future thinking (e.g., Cha et al., 2022). However, in the current study, the correlations between the AST, AFT, and EDT as well as the results from the PCA suggests that these tasks are capturing similar components of EFT. The VVIQ did not correlate with any of the other future thinking measures. The VVIQ is designed to measure the vividness of a mental image, and the very definition of vividness includes the richness, detail and clarity of a mental image (D'Anguilli & Reeves, 2007), one would therefore expect there to be a relationship with the other measures used in the current study to capture richness (the EDT). It is unclear why the VVIQ did not correlate with the other future thinking tasks. It could be due to the to the nature of the to be imagined events. In the EDT, participants were required to imagine a plausible and novel event they would carry out on their next holiday. In the AFT, participants generated as many possible personal events that may occur across three future time points. The AST required participants to generate specific future events in response to a series of cue words. The VVIQ presented four to be imagined scenarios: the image of a friend or relative, a rising sun, a familiar shop front, and a country scene. It may be that the rising sun and country scene were less episodic in nature and therefore did not relate to the specific episodic tasks. As previously mentioned, it could also be due to the modality i.e., the EDT, AST, and AFT require the generation of episodic future thoughts which are reported verbally (and not necessarily visually), whereas the VVIQ specifically requires mental image construction. The findings in the current study support Hallford et al. (2019) who found weak correlations between a verbal (written) EFT task and a visual imagery task (Spontaneous Use of Imagery Scale; SUIS), and no correlation between a verbal EFT task and a second visual imagery task (Prospective Imagery Task; PIT). It may be that the VVIQ involved different component processing compared to the EDT, AFT and AST. D'Argembeau et al. (2010) found that executive processes were correlated with different features of future thinking (AST and EDT) in comparison to visual-spatial processing (which was

specifically correlated with the number of sensory details reported). It is therefore likely that there is a divergence in verbal representations and mental imagery representations.

Limitations

We did not measure non-episodic processes that may have been involved when participants completed the future thinking tasks such as semantic retrieval or narrative style. As semantic retrieval and narrative style have been shown to be dissociable from EFT (Schacter et al., 2017), future research should consider measures that separate episodic and non-episodic influences on task performance e.g., the Episodic Specificity Induction (ESI; Madore et al, 2014).

The same coding system was used for the EDT and participants verbal descriptions of their truthful and deceptive mental images and their truthful and deceptive planning tasks. It was decided to use the same coding system for consistency when comparing performance across the tasks. It is possible that the coding system was measuring some other skill besides EFT ability or truth-telling/lying ability (e.g., descriptive ability or engagement with the task). Perceptual details are frequently used as a measure in future thinking tasks e.g., the autobiographical interview (Levine et al., 2002), the Memory Characteristics Questionnaire (Johnson et al., 1988), the Experiential Index (Hassabis et al., 2007), as well as a measure in truth-telling and lying behaviour (e.g., Warmelink et al., 2012; Warmelink et al., 2019; Warmelink & O'Connell, 2022). However, using the same coding system to measure a cognitive ability and performance on a cognitive task may have created a spurious correlation.

EFT ability declines with age (Addis et al., 2008; Gamboz et al, 2010), and there is recent evidence to suggest that the effect of lying on memory reduces with age (Paige et al, 2019). The sample used in the current study consisted of undergraduate psychology students. The effect of EFT ability on task performance may have been different if the sample included older adults, therefore future research exploring the effect of EFT ability on cognitive tasks should consider varying the age of participants.

Conclusion

The current study explored participants EFT ability using five future thinking tasks and assessed their relationship with participants' performance on a truthful and deceptive task. The aim of the study was to determine which single EFT task was the most valid measure to use in subsequent studies throughout the thesis. The EDT was found to be the most appropriate task. The results also suggested that whilst the EDT, AFT, and AST were all measuring different aspects of EFT (episodic details, fluency, and specificity) the relationship between these measures suggests they

were measuring a similar construct of EFT. The results also suggest that the VVIQ may be related to a different component of EFT.

Supplementary Materials: AST Cue Words

List A				List B			
	Imaginability mean	Frequency	Letter Count		Imaginability mean	Frequency	Letter Count
Garden	6.34	78.29	6	**Donkey**	6.35	78.81	6
Buffet	6.38	80.01	6	**Office**	6.34	78.29	6
Puppy	6.39	80.48	5	**Cinema**	6.38	80.01	6
Choice	3.01	9.86	6	**Advice**	3.10	11.48	6
Interest	3.02	10.07	8	**Reverse**	2.95	8.61	7

Chapter 4: The Effect of Individual Differences in Episodic Future Thought on Perceived Credibility

Abstract

In this paper, we describe four studies that explore how individual differences in Episodic Future Thought (EFT) affect the ability to be perceived as credible, both when telling the truth and when lying. In Study 1a, we measured participants EFT ability and asked them to give a truthful and deceptive statement about their intentions. It was found that statements provided by individuals with higher EFT ability showed several characteristics associated with credibility (including length and level of detail) than statements provided by individuals with lower EFT ability. Study 1b showed that when lying, but not when telling the truth, high EFT individuals were perceived as more credible than low EFT individuals by other participants. In Study 2a, we replicated Study 1a in written format: higher (versus lower) EFT individuals provided longer and more detailed truthful and deceptive statements. Study 2b showed that truthful and deceptive statements written by high EFT individuals were perceived as more credible than those written by low EFT individuals. Overall, the results show that EFT ability predicts the ability to credibly tell the truth and lie about intentions.

Keywords

Episodic Future Thought, Future Thinking, Deception, Lying, Intentions

Introduction

Discriminating between truthful and deceptive intentions is a particular form of deception detection that focusses on future events. There are many applications that require the assessment of true and false intentions e.g., for crime prevention purposes in law enforcement and intelligence agencies (for a review see Granhag & Mac Giolla, 2014). An intention is defined as an actor's mental state preceding a corresponding action, which unlike related concepts such as desires, come with a commitment to perform the action and are often based on some amount of planning. Previous studies on deception about intentions have focussed on the differences between truthful and deceptive intentions when giving verbal statements (Granhag & Mac Giolla, 2014). Results have shown that truthful intentions are more plausible (Vrij et al., 2011), longer in length (Sooniste et al., 2013) and contain more details (Warmelink et al., 2013) than deceptive intentions. Deception detection techniques used to detect lies about past events have successfully been extended to the study of truthful and deceptive intentions (e.g., the strategic use of evidence technique; Clemens et al., 2011). Other research has adopted intention specific approaches to detect deception for example, by targeting the goals (Ask et al., 2013), planning (Sooniste et al., 2013), and mental imagery (Knieps et al., 2013) that are associated with intentions. Despite the rapid growth of interest in true and false intentions, research examining the underlying cognitive mechanisms involved in telling the truth or lying about intentions is lacking (Blandón-Gitlin et al., 2014). The current study attempts to explore one possible mechanism of truth telling and lying, by examining truth telling and lying behaviour from an individual differences perspective.

Individual differences in credibility

Previous studies have demonstrated individual differences in the ability to lie and tell the truth credibly (DePaulo & Rosenthal, 1979; Riggio et al., 1987; Vrij et al., 2010). Credible demeanour can be consistent across situations. Bond et al. (2015) found that participants who looked honest (on video) also sounded honest (via audio), and their written transcripts also appeared more credible. Research has explored what enables individuals to be 'good', credible liars. Credible lying has been associated with certain personality traits e.g., Machiavellianism (DePaulo & Rosenthal, 1979; Geis & Moon, 1981), dominance and high exhibition (Riggio & Friedman, 1983), extraversion and being socially skilled (Riggio et al, 1987a; Riggio et al, 1987b) and psychopathy (Billings, 2004). However, other studies have failed to demonstrate such associations (e.g., Wright et al, 2015). Vrij et al. (2010) propose certain characteristics that constitute a 'good' liar such as their personality, behaviour, emotions, response to cognitive load and decoding skills. According to Vrij et al. (2010), some

individuals exhibit suspicious behaviour whereas others display behavioural patterns associated with honesty and likeability. This notion has been supported in sender demeanour studies. Bond and DePaulo's (2008) meta-analytic findings showed that regardless of the veracity of a message, senders with a truthful and credible demeanour were more likely to be believed. The authors suggest that the outcome of a deception judgement depends more on the skill (or lack of skill) of the liar than the acuity of the lie detector. This demeanour bias has been demonstrated in other studies (Burgoon et al., 2008; Porter & ten Brinke., 2009; Levine et al., 2010). Furthermore, Levine et al. (2011) found that when veracity and demeanour were matched (e.g., sincere + truthful condition, insincere + deceptive condition), accuracy rates were significantly higher than when veracity and demeanour were mismatched, i.e., sincere liars were incorrectly judged as honest and insincere truthtellers were incorrectly judged as deceptive. The demeanour of the sender therefore plays an important role when judging veracity.

Vrij et al. (2010) suggest that due to their confidence and greater experience in lie telling behaviour, good liars will experience feelings of guilt and fear to a lesser extent. Where feelings of fear or guilt are experienced, good liars are better able to conceal these emotions, thus increasing the difficulty of successful lie detection. Vrij et al. (2010) also suggest lie telling behaviour will be less cognitively demanding for good liars, as they will prepare more and provide less verifiable information. Overall, the authors propose that good liars will be original and quick thinking, possess good memory, and have the ability to monitor the behaviour of the receiver to adjust their own behaviour if they feel the receiver is suspicious. This suggests that there may be individual differences in cognitive processing skills, which good liars possess to a greater extent or perform quicker than less successful liars.

Research has explored the cognitive processes involved in truth telling and lying ability. Cognitive processes such as inhibitory control, task switching and working memory have been shown to be important contributors for successively lying about current or past events (Atkinson, 2019). Maldonado et al. (2018) found that when lying, individuals with low working memory capacity (vs. high working memory capacity) had greater difficulty remembering the truth and were more easily detected as liars. Briazu et al. (2017) found that individuals with greater counter factual thinking ability generated more lies than individuals who think less counterfactually, suggesting that the cognitive skills used for counterfactual thinking also effect lying ability. Lying ability has also been linked to self-awareness i.e., individuals with higher private self-awareness are more successful liars than those with lower private self-awareness (Johnson et al., 2005). These findings indicate that lying about present or past events draws on various cognitive processes and it is likely that these processes are also important for lying about intentions. However, lying about intentions may

involve additional cognitive processes related to future thinking. In this paper, we propose that individual differences in sender credibility may be related to Episodic Future Thought (EFT), both when telling the truth and when lying about intentions.

Episodic Future Thought (EFT)

EFT represents the ability to mentally pre-experience future events in one or several visual images (Szpunar, 2010). It is suggested that EFT depends on episodic memory (EM) i.e., the ability to recollect past personal experiences (Tulving, 2002). This link between EM and EFT has been demonstrated in clinical studies whereby patients displayed deficits in EM and EFT (Addis et al., 2009; King et al., 2011; Klein et al., 2002; Rosenbaum et al., 2009). Schacter and Addis (2007) proposed the constructive episodic simulation hypothesis in which EM provides the constructive processes to retrieve and recombine stored episodic details into a novel episode. This hypothesis has been supported by neuro-imaging studies in which overlapping neural areas are engaged during EM and EFT. These areas have been described as the 'core network' and include the medial temporal and frontal lobes, posterior cingulate and retrosplenial cortex as well as the lateral parietal and temporal areas (Schacter et al, 2012; Benoit & Schacter, 2015). However, EFT fitting into an exclusively episodic model has been challenged by other research demonstrating the importance of semantic memory (SM) in future-oriented mental time travel (e.g., Abraham et al., 2008; Anderson, 2012; Klein 2016; Irish et al., 2012).

Other researchers have suggested that the ability to imagine future events involves various component processes such as working memory (Suddendorf & Corballis, 2007; Hill & Emery, 2013), executive functioning (D'Argembeau et al, 2010), and scene construction (Hassisbis & Macguire, 2007; 2009). To organise the vast array of ways that individuals think about the future, Szpunar et al. (2014) use the concept of prospective cognition to propose 4 interactive categories of future thinking: Simulation (the mental construction of a detailed depiction of the future); prediction (approximation of the probability and/or reaction to a future outcome); intention (mentally setting a goal); and planning (identifying and organising actions to achieve a goal). Whilst episodic future thinking could potentially fall under all of these categories, almost all studies involving EFT focus on episodic simulation (Schacter et al., 2017). The functional benefits of EFT have been demonstrated in tasks such as decision making (e.g., relating to dietary choices, alcohol and smoking consumption; Dassen et al., 2016; Snider et al., 2016; Stein et al., 2016; Sze et al., 2017); problem solving (Madore & Schacter, 2014), emotion regulation (e.g., coping; Jing et al., 2016; Benoit et al., 2016); goal processing (Taylor et al., 1998); implementation intentions, and planning (Altgassen et al., 2015; Schacter et al, 2017; Spuznar, 2010). Granhag and Knieps (2011) were the first researchers to apply the theory of EFT to explore how the formation of true and false intentions may differ. During the

planning phase of a truthful intention, an individual will evoke perceptually vivid mental images (Szpunar, 2010). It is assumed that individuals will draw on EFT more and plan truthful intentions in a more perceptually detailed way versus those that plan a deceptive intention – different to their true intention (Granhag & Knieps, 2011). They found that truth-tellers reported evoking a mental image to a greater extent (97%) than liars (66 %), indicating that truth-tellers might be engaging in EFT more often than liars. Truth-tellers also provided richer verbal descriptions of their mental image than liars. Knieps et al. (2013a) and Knieps et al. (2013b) replicated Granhag and Knieps (2011) findings that truth-tellers evoke a mental image to a greater extent than liars. Whilst these results suggest that EFT may be involved in lying about intentions, it is not clear whether there are individual differences in engagement with EFT and if this extends to the credibility of the liar.

Prior research has demonstrated that there are individual differences in the ability to construct detailed mental representations when imagining future events (D'Argembeau & Van der Linden, 2006). Furthermore, individual differences in executive functioning predicts the quantity and quality of episodic details given about specific future events (D'Argembeau et al, 2010; Hill & Emery, 2013). These findings suggest that individual differences in cognitive processes affect the ability to imagine future scenarios. However, it is not known whether these individual differences in the ability to imagine future scenarios affects how credible these individuals are when telling the truth and lying about future events. As prior research has demonstrated individual differences in truth telling and lying ability (e.g., Vrij et al., 2010), and individual differences in the ability to mentally construct future events (e.g., D'Argembeau & Van der Linden, 2006), the current series of studies sought to explore this link directly, i.e., do individual differences in EFT ability affect the ability to tell and truth and lie credibly?

Current Study

To test the link between EFT ability and sender credibility, we carried out four separate studies. In Study 1a, we measured participants EFT ability and asked participants to give a truthful statement and a deceptive statement about their intentions (using a similar experimental design to Granhag & Knieps, 2011). Participants were interviewed twice (once in each veracity condition) and were asked to describe their intentions in as much detail as possible, describing any mental images formed whilst planning their intentions. Participants' truth-telling and lying ability was measured by the number of perceptual details and length of response in their descriptions of their truthful and deceptive intentions and their truthful and deceptive mental images. We further measured their truth-telling and lying ability by asking a separate group of participants to judge the veracity of their truthful and deceptive statements (Study 1b).

In Studies 2a and 2b, we tested the same link between EFT ability and credibility in written statements. We measured participants EFT ability and asked participants to give a truthful written statement and a deceptive written statement (Study 2a). As in Study 1a, we measured truth-telling and lying ability by the number of perceptual details and length of response. We then asked a separate group of participants to judge the veracity of these written accounts (Study 2b).

Study 1a: Purpose and Predictions

Study 1a measured participants EFT ability and asked them to create a truthful intention by planning a task to carry out on campus. We also asked participants to create a deceptive intention, by planning a cover story to mask their true intention and to use this cover story if they were intercepted and asked questions about their intentions. If EFT ability is a process underlying truth-telling and lying ability, or if both EFT and the ability to tell the truth and lie about intentions share the same underlying processes, we should find a positive association between EFT ability and truth-telling and lying ability.

Hypotheses 1: EFT ability

Interview

Based on Granhag & Knieps (2011), Knieps et al. (2013a) and Knieps et al's (2013b) findings that truth tellers report the activation of a mental image to a greater extent than liars, and prior evidence of individual differences in the ability to imagine future scenarios (D'Argembeau & Van der Linden, 2006; D'Argembeau et al, 2010; Hill & Emery, 2013), we predicted that participants with higher EFT ability will report the activation of a mental image whilst planning their intentions task more frequently than those with lower EFT ability (Hypothesis 1a). We expected that participants with higher (vs. lower) EFT ability will use more details and words to describe their truthful and deceptive intentions (Hypothesis 1b) and truthful and deceptive mental images (Hypothesis 1c; Granhag & Knieps, 2011; Knieps et al., 2013b).

Post-Interview Questionnaire

Based on D'Argembeau & Van der Linden's (2006) findings of individuals with greater capacity for vivid visual imagery experiencing more visual and spatial details when imagining future events and Granhag & Knieps (2011) findings, we predicted that participants with higher EFT ability would rate the extent to which they formed a mental image (Hypothesis 1d), pre-experienced their future event (Hypothesis 1e) and ratings of perceptual details (sensory, spatial and temporal; Hypothesis 1f) to be higher than those with lower EFT ability. Finally, participants with higher EFT ability will rate the difficulty of answering the question 'During your interview you was asked, did

you at any point during your planning evoke a mental image of an event?', as easier than those with lower EFT ability (Hypothesis 1g).

Hypotheses 2: Veracity

Interview

Based on Granhag & Knieps. (2011), Knieps et al., (2013a) and Knieps et al., (2013b), we expected that participants will report the activation of a mental image whilst planning their intentions task more frequently in the truthful than the deceptive interview (Hypothesis 2a). In light of previous research demonstrating truthful intention statements to be longer in length (Sooniste et al., 2013) and contain more details (Warmelink et al., 2013) than deceptive intentions, in addition to Granhag and Knieps (2011) and Knieps et al. (2013b) findings, we also predicted that participants would use more details and words to describe their truthful vs. deceptive intentions (Hypothesis 2b) and truthful vs. deceptive mental images (Hypothesis 2c).

Post-Interview Questionnaire

We expected to replicate Granhag and Knieps (2011) post-interview questionnaire veracity effects: participants would rate the extent to which they formed a mental image (Hypothesis 2d), pre-experienced their future event (Hypothesis 2e) and ratings of perceptual details (sensory, spatial and temporal; Hypothesis 2f) higher in the truthful (vs. deceptive) condition. As in Granhag and Knieps (2011), we also predicted that participants would rate the difficulty of answering the question 'During your interview you was asked, did you at any point during your planning evoke a mental image of an event?', as easier in the truthful (vs. deceptive) condition (Hypothesis 2g).

Study 1a: Method

Participants

We conducted a priori power analysis (using G*power): alpha was set at 0.05 and power was set at 0.95. Power was set at 0.95 because we wanted to ensure that this first study in the series had a high chance of finding an effect before proceeding with the subsequent studies. The power analysis assumed two tailed, a H0 of 0, H1 variance explained of 0.2, 5 predictors (the various EFT measures; see 2.2.3 materials subsection) and a small effect size of 0.2. The DV was level of detail. This analysis suggested 102 participants would be needed. 104 participants (75 women, 29 men; M_{age} = 20.25 years, *SD*=2.95) were recruited via the University's research participation system. 72 participants earned 2 course credits for participation; the remaining 32 participants were paid £7 each for taking part. See supplementary materials for analyses of the differences between these two groups.

Design

A 2(Veracity: Truthful vs. deceptive) x 3 (Order of tasks: 1 vs. 2 vs. 3) mixed design was used. Veracity was the within-subjects factor and the order of tasks was the between-subjects factor. Participants were randomly assigned to one level of the between-subjects factor. The dependent variables were the number of details and words participants used in their truthful and deceptive intentions task descriptions and mental image descriptions; the reporting of the activation of mental image; and participant's EFT ratings in the post-interview questionnaire.

Materials

In accordance with the pre-registration (https://osf.io/bpkf3/?view_only=b6a8b30866fb4cae85bfa31f6b5c8e5b), participants EFT ability was measured using five future thinking tasks: An episodic details task (EDT; D'Argembeau et al., 2010) combined with a Memory Characteristics Questionnaire (MCQ; Johnson et al., 1988); a cue response task (D'Argembeau et al., 2010); a future fluency task (D'Argembeau et al., 2010); and a Vividness of Visual Imagery Questionnaire (VVIQ; Marks., 1973). As the EDT task predicted performance across all measures (participants descriptions of their truthful and deceptive mental images and their descriptions of their truthful and deceptive intentions), it was decided that this measure will be used in the current series of studies to measure participants' EFT ability (for details of the EFT tasks see https://osf.io/zhfmr/?view_only=6693d8e68bc24e34be65723f7a897492, for a critical review of all the EFT measures and the analysis that informed the use of the EDT in the current study see Chapter 3).

The Episodic Details Task was adapted from D'Argembeau et al. (2010) and required that participants imagined something they will do on their next holiday. Participants were asked to report aloud as much detail as possible about the event, including where they plan on going, who they will be with, what is around them, and any other details they could formulate. Immediately after this task, participants were asked to complete 24 questions adapted from the MCQ (Johnson et al., 1988). These questions related to the participants' subjective experience of the event they had described. Participants rated their answers on a 7-point scale; for example, clarity of location (1= vague, 7= very clear); smell/taste (1= little, 7= a lot); and visual details (1= little, 7= a lot).

Procedure

Ethical approval for the current study was obtained from Lancaster University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants arrived at the laboratory, read a participant information sheet, and then provided written consent to take part. The procedure was based on a similar experimental set up to Granhag and Knieps (2011).

Participants were randomly assigned to 1 of 3 groups which determined the order of the tasks (see Table 3.1 on page 35).

Intention planning tasks

Participants completed both a truthful and deceptive intentions task in a counter balanced order. In the deceptive intention condition, participants planned to place a memory stick containing 'illegal' material in-between two specific books in the campus library. They were also instructed to plan a cover story and use this cover story if they were intercepted and asked about their intentions. In the truthful intention condition, participants were asked to plan one of five tasks (such as buying 2 gifts for a friend for £20 or buying £17 worth of snacks for a psychology event involving 17 students), and if intercepted they were told to just tell the truth. The full set of intention tasks (A-F) are presented in the supplementary materials. Five truthful tasks were created to ensure the interviewers were kept blind to the truthful and deceptive tasks. All tasks were similar in that participants were given something (e.g., money or a ticket) and asked to go to another area of the university campus to buy or collect items and bring them back. In both veracity conditions, participants were given a map of the university campus to help plan their task(s). Participants were told that they only had one chance and a short amount of time to complete the task. Participants (in both conditions) were left for five minutes to plan their task. The researcher then asked the participants if they understood their task and in the deceptive condition reminded them to use their cover story if they were intercepted. Participants (in both veracity conditions) were told that if they were intercepted and asked questions about their intentions, this person would not know whether they are telling the truth or lying and that it was their job to convince this interviewer that they were telling the truth. As a manipulation check, before leaving the room, participants were asked to briefly write down what they were about to do next. All participants passed the manipulation check.

Interception and interviews

Immediately after the participants left the room and made their way towards the exit (carrying either the 'illegal' USB stick, a £20 note, or a ticket in their pocket/bag – depending on their task), they were intercepted by another researcher who explained that they were part of the study and asked them to go into a nearby room to answer some questions. All participants were interviewed individually and answered a structured set of questions (see supplementary materials for full set of interview questions). Responses to two interview questions were coded for analysis: the intentions question, 'I want you to tell me about your intentions for task [a/b/c/d/e/f]. Please tell me about each and every step – and try to be as detailed as possible', and the mental image question 'Can you please describe the most dominant mental image in as much detail as possible?'.

Upon completion of each interview, the researcher asked the participant to return to the original room to complete a post-interview questionnaire. The interviewer completed a short questionnaire indicating whether they thought the participant was lying or telling the truth and the reason for their judgement. The same interception and interview procedure was used for both veracity conditions.

Post-interview questionnaires

Immediately after each interview, all participants were asked to complete a post-interview questionnaire (see supplementary materials for full questionnaire). The first question was a manipulation check asking participants to rate on a 7-point scale how truthful they were during the interview from 1 (everything I told was true) to 7 (everything I told was a lie). Participants were then asked to rate the basic features relating to the planning of the intentions: How difficult they found the planning (1=very easy, 7=very difficult), as well as the sufficiency of the planning time, their satisfaction with the planning, and how interesting they found the planning all on a 7-point scale (1 = Not at all sufficient/satisfied/interesting, 7 = Totally sufficient/very satisfied/very interesting). In the next part of the questionnaire, participants were asked 'to what extent did you form a mental image while planning your errand/cover story?' (1 = To a very low extent, 7 = To a very high extent). Following this, participants were presented with seven questions based on the MCQ (Johnson et al., 1988). These questions related to the participant's subjective experience of the most dominant mental image activated during the planning of their intentions/cover story including sensory, spatial and temporal details. Participants were asked how clearly they pre-experienced the event/cover story from 1 (to a very low extent/no strong feeling of pre-experience) to 7 (to a very high degree/very strong feeling of having pre-experienced). The final question asked participants to rate the difficulty of answering the main EFT question asked during the interview (i.e., 'Did you at any point during your planning, evoke a mental picture of the future event?') from 1 (not at all difficult) to 7 (very difficult).

Following the post-interview questionnaire, participants were debriefed and thanked for their time. Participation in the study took between 40 and 60 minutes.

Coding

The episodic details task and both interviews were transcribed verbatim. Two coders (blind to the veracity status of the participants) coded the episodic details task, participants descriptions of their truthful and deceptive intentions, and participants descriptions of their truthful and deceptive mental images. There were five 'detail' coding categories: spatial, entity, sensory, thought/emotion/action, and temporal (D'Argembeau et al., 2010; see Table 9.1 in supplementary materials for category descriptions and examples). One coder rated 100% of participant responses

and another coder rated a randomly selected 25% of participant responses. Inter-rater reliability between the two coders was excellent for the episodic details task: ICC =.962, 95% CI [.917, .983], the intention question descriptions: ICC = .991 95% CI [.971, .996], and the mental image question descriptions: ICC = .983, 95% CI [.927, .993]. One coder rated responses as Yes versus No to the question 'At any point during your planning, did you evoke a mental image of the future event?'

All data and code have been made available at [Open Science Framework] and can be accessed at [https://osf.io/zhfmr/].

Study 1a: Results

Manipulation checks and exclusions

Although we did not preregister data exclusions, we removed the data for participants who failed to lie in the deceptive interview (*N*=10) and participants who answered the manipulation check incorrectly (e.g., those who circled the statement 'everything I said was a lie' when they had in fact told the truth (*N*=3)) on the post interview questionnaire. This left 91 participants (66 women, 25 men; M_{age} = 20.32 years, *SD*=3.02) in total for the intention description analyses. For the mental image analyses, we also removed the participants who reported that they did not form a mental image (*N*=12). This left 79 participants (56 women, 23 men; M_{age} = 20.35 years, *SD*=3.07) in total for the EFT measures analyses.

A Wilcoxon signed-rank test showed that in the deceptive condition, participants (*N*=90, *M*=5.28, *SD*=1.46) rated their level of lying significantly higher than when telling the truth (*N*=90, *M*=1.23, *SD*=0.70), $p<.001$, indicating that participants understood and correctly followed the instructions to lie or tell the truth. Participants were more satisfied with the sufficiency of their planning time (five minutes) in the truthful condition (*N*=93, *M*=6.31, *SD*=1.20), than in the deceptive condition (*M*=5.51, *SD*=1.74, *Z*=-4.03, $p<.001$, *d*=0.92).

Hypotheses-testing Analyses

EFT ability and activation of mental image. Logistic regression showed that EFT ability (as measured by EDT score) did not predict the activation of a mental image in the truthful interview, *b*= .001, *SE= .001,* $t(91) = 0.91$, $p = .363$, nor the deceptive interview, *b*<.0001, *SE*<.0001*,* $t(91) = 0.02$, $p = .982$, therefore Hypothesis 1a was not supported.

EFT ability and truth-telling and lying ability

Intentions Description. We used linear regression to examine whether EDT task score predicted the number of details and words used when participants described both their truthful and deceptive intentions (see Table 7.1). As predicted in Hypothesis 1b, individuals with higher EDT scores provided more detailed and longer descriptions of their intentions in both veracity conditions.

Table 7.1

Linear regression - EDT score predicting number of details and words used in truthful and deceptive intention descriptions

		b	*SE*	*t*	*p*
Intentions Details	Truthful	.28	.09	3.19	.002
	Deceptive	.17	.05	3.45	<.001
Intentions Words	Truthful	.63	.17	3.75	<.001
	Deceptive	.34	.09	3.79	<.001

EFT ability and truth-telling and lying ability

Mental Image Description. As predicted in Hypothesis 1c, EDT scores predicted the number of details and words used when participants described both their truthful and deceptive mental images: individuals with higher EDT scores provided more detailed and longer descriptions of their mental images in both veracity conditions (see Table 7.2).

Table 7.2

Linear regression - EDT score predicting number of details and words used in truthful and deceptive mental image

		b	*SE*	*t*	*p*
Mental Image Details	Truthful	.35	.07	5.28	< .001
	Deceptive	.27	.06	4.26	< .001
Mental Image Words	Truthful	.79	.16	4.97	< .001
	Deceptive	.63	.13	4.73	< .001

EFT measures - Post Interview Questionnaire. We used ordinal regression to test whether EDT scores predicted ratings on all the subjective EFT measures from the post-interview

questionnaire. EDT scores predicted all ratings except the difficulty in answering the mental image question in the truthful condition (see Table 7.3). Therefore, Hypotheses 1d, 1e and 1f were supported and Hypothesis 1g was partially supported.

Table 7.3

Ordinal regression table for EDT scores predicting responses to EFT measures in the post interview questionnaire (N=80)

		b	*SE*	95% *CI*	*p*
Formation of mental image	Truthful	.79	.16	.47, 1.10	<.001
	Deceptive	.63	.13	.36, .89	<.001
Pre-experiencing future event	Truthful	.27	.09	-.08, .46	.005
	Deceptive	.17	.05	.07, .28	.002
Perceptual details mental image	Truthful	.61	.18	.25, .97	.001
	Deceptive	.34	.09	.15, .53	.001
Difficulty answering mental image question	Truthful	-.00	.01	-.01, .01	.859
	Deceptive	.27	.01	.14, .40	< .001

Effect of veracity – Intentions description and mental image description. Using a Wilcoxon signed rank test, we found that participants used more details and words when describing their truthful versus deceptive intentions, supporting Hypothesis 2b. However, no differences in the number of details or response length emerged between participants descriptions of their truthful and deceptive mental image descriptions (see Table 7.4). Therefore, Hypothesis 2c was not supported[1].

Table 7.4

Wilcoxon signed rank test for number of details and words used in intentions description and mental image description in the truthful versus deceptive conditions

	Truthful Condition *M* (*SD*)	Deceptive Condition *M* (*SD*)	*Z*	*p*	*d*

[1] There was no interaction effect between EDT scores and veracity condition for details (β=.09, *SE* = .07, *t* = 1.33, *p* = .186) or number of words (β=.22, *SE* = .14, *t* = 1.60, *p* = .111).

Intentions Description	Details	37.02 (*26.14*)	28.99 (*15.07*)	-3.14	.002	0.33
	Words	75.08 (*51.52*)	55.69 (*27.58)*	-4.22	<.001	0.44
Mental Image Description	Details	28.30 (*21.07*)	25.58 (*19.27)*	-9.40	.347	1.05
	Words	65.45 (*49.74*)	56.35 (*28.19*)	-.76	.449	.17

Effect of veracity on EFT measures – Post- interview Questionnaire. A Wilcoxon sign rank test demonstrated no differences between the truthful and deceptive conditions in terms of participant ratings of the EFT measures in the post-interview questionnaire (see Table 7.5). Therefore, Hypotheses 2d, 2e, 2f and 2g were not supported.

Table 7.5

Wilcoxon signed rank test post interview questionnaire EFT measures in truthful versus deceptive conditions (N=80)

	Truthful Condition	Deceptive Condition			
	M (*SD*)	*M* (*SD*)	*Z*	*p*	*d*
Formation of mental image	5.40 (*1.26*)	5.34 (*1.33*)	-.67	.502	0.15
Pre-experiencing future event	5.25 (*1.27*)	4.99 (*1.30)*	-1.51	.130	0.35
Perceptual details mental image	24.71 (*4.96*)	23.90 (*4.50)*	-1.51	.132	0.35
Difficulty answering mental image question	2.95 (*1.53*)	3.25 (*1.45*)	-1.54	.123	0.35

As predicted in Hypotheses 1b and 1c, results from Study 1a showed that individuals with higher EDT scores used more details and words when describing both their truthful and deceptive intentions and mental images. In Study 1b, we examined whether these higher EFT individuals were judged as more credible than the lower EFT individuals.

Study 1b: Purpose and Predictions

To test whether higher EFT individuals were perceived as more credible than lower EFT individuals, we asked participants in study 1b to judge the veracity of the verbal accounts given by participants in Study 1a.

Hypothesis 3 Credibility

Prior evidence has demonstrated individual differences in truth telling and lying ability (e.g., Vrij et al., 2010) and various cognitive processes have been linked to successful lie telling behaviour

(e.g., working memory; Maldonado et al, 2018). Based on these findings and our proposition that EFT ability may be involved in truth-telling and lying ability, in the current study we predicted that the accounts provided by higher EFT individuals in both the truthful and deceptive conditions would be judged as more credible than the accounts given by lower EFT individuals.

Study 1b: Method

Participants

To ensure each audio recording from Study 1a was rated by an observer at least 20 times, 104 participants (86 female, 18 male) were recruited, aged between 18 years old and 72 years old (M_{age}=24.8 years, *SD*=12.7). 84 participants were recruited via the University's research participation system and earned 1 course credit for participation. The remaining 20 participants were recruited via word of mouth and advertisements around the university campus and received no reward. None of the 104 participants recruited for Study 1b had taken part as participants in Study 1a.

Design

The study used a within-subjects design where participants judged the veracity (truth vs. lie) of the audio clips derived from study 1a. Each participant rated 20 audio clips (10 truthful and 10 deceptive). The audio clips were randomly selected on the survey platform Qualtrics. The dependent variables were the veracity judgment: 'do you believe this individual is telling the truth?' Yes vs. No; participants' self-ratings of confidence in their veracity judgement on a 5-point scale from 1 (not at all confident) to 5 (very confident); and participants ratings of how plausible they found the account on a 5-point scale from 1 (not at all plausible) to 5 (very plausible).

Materials

206 audio clips were derived from Study 1a. The audio clips were of participants' responses to the interview question 'I want you to tell me about your intentions for task (a/b/c/d/e/f). Please tell me about each and every step – and try to be as detailed as possible'. 20 of these clips were removed as 10 participants failed to lie (i.e., they told the truth in the deceptive condition, both their truthful and deceptive responses were removed). A further 16 were removed due to either one or both of the audio-recordings of the responses from these participants being inaudible. This resulted in 170 audio clips (86 deceptive, 84 true) for use in Study 1b. Each participant was presented with 20 audio clips; however, we experienced a high rate of data loss with some participants skipping through the survey and failing to rate each clip. Hence, overall, each clip was judged between 8 and 14 times.

Procedure

Ethical approval was obtained from Lancaster University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants accessed the online link via the university's research participation system or the social media platform through which they were recruited. Participants first read a participant information sheet and then signed a consent form online. The survey was completed via the online survey platform Qualtrics. The survey program randomly selected 20 audio clips for each participant, while ensuring that participants did not view the same clip twice. Participants were informed that they would be presented with 20 audio clips in which different individuals would describe themselves carrying out a specific task. After each audio clip participants were asked, 'do you believe this individual is telling the truth?' and responded yes or no. They were then asked to rate their level of confidence in their veracity judgement on a 7-point Likert scale from 1 (not at all confident) to 7 (very confident) and the plausibility of the account, from 1 (not at all plausible) to 7 (very plausible). Upon completion of the study, participants read a debrief explaining the nature of the study. Participation took between 10 and 45 minutes.

Data Analysis

We used multilevel models to analyse the data as Generalised Linear Mixed Models (GLMMs) allow for individual observations for each participant to be entered without assuming interdependence (Baayen et al., 2008). To run the analyses on the veracity judgement we created 2 datasets (truthful and deceptive) with one row of data for each veracity judgement made by participants. This comprised of 1016 rows in the truthful condition and 1005 rows in the deceptive condition. As the dependent variable was binary (veracity judgement – 0=Deceptive, 1=Truthful), we fitted logistic multilevel models using the glmer function from the lme4 package in R (Bates et al., 2015). When building up our models, we used ANOVA to compare the Akaike Information Criteria (AIC) of the more simple and complex models. We ran Chi-square to test whether each [more complex] model was significantly better at explaining our data than the simple model. The model with the lowest AIC value was chosen as the best fit to explain our data. Where two models did not differ significantly, the model with the fewer predictors was considered better. All statistical tests were 2-tailed. Accuracy rates by sender can be found on the OSF project page [https://osf.io/zhfmr/].

Study 1b: Results

We estimated a logistic multilevel model with the interviewee's EDT score as a fixed effect and random effects for Rater and Audio Number. EDT score did not predict the likelihood that the audio was rated as true in the truthful condition, β = -0.001, *SE* = 0.003, *z*=-0.19, *p*=.852. However, in the deceptive condition, EDT score did predict the likelihood that the audio was rated as true. When

individuals with higher EFT ability were lying, they were more likely to be judged as truthful than participants with lower EFT ability who lied, β = 0.01, *SE* = 0.004, *z*=2.36, *p*=.018. Therefore, Hypothesis 3 was partially supported.

On average, participants confidence ratings were slightly higher when making deceptive judgements (*M* = 3.57, *SD* = 1.03) versus truthful judgements (*M* = 3.53, *SD* = 1.01). The plausibility of the account significantly predicted participants' veracity judgements (β = 1.32, *SE* = 0.07, *z*=17.88, *p*<.001). Participants rated truthful accounts as more plausible than deceptive accounts. Plausibility was not affected by the EFT ability of the speaker (β = .002, *SE* = 0.03, *z*=.77 *p*=.44).

Studies 1a and 1b: Discussion

Study 1a found that higher EFT individuals provided more detailed and longer truthful and deceptive verbal accounts of their intentions than those with lower EFT ability. The findings of Study 1b demonstrate that, in comparison to individuals with lower EFT, those with higher EFT were judged as more credible when lying. Studies 1a and 1b involved verbal accounts. We considered that the EFT effect found may be due to participants differing in how much they were willing to speak to the interviewer and the experimenter during the EDT tasks and interviews, rather than how much they engaged in EFT. We therefore decided to remove the talking element and explore whether the same EFT effect could be found when participants' responses are in written format (Study 2a).

Study 2a: Purpose and predictions

Studies 2a and 2b are a conceptual replication of studies 1a and 1b with a change in format from verbal to written. In Study 2a, we measured participants EFT ability using the same Episodic Details Task used in Study 1a, but in written format. We designed a truthful written task and a deceptive written task. The truthful task required participants to tell the truth about their plans for the next weekend. The deceptive task required participants to respond deceptively to a mock wedding invitation.

Hypotheses 4: EFT Ability

Based on our findings in Study 1a, we predicted that individuals with higher EFT ability would use more words and details in both their truthful and deceptive written accounts than those with lower EFT ability.

Hypothesis 5: Veracity

Based on our findings in Study 1a, we expected that truthful accounts would contain more details and words than deceptive accounts.

Study 2a: Method

Participants

G*power was used to conduct the same a priori power analysis as used in Study 1a, using the exact test family and a linear multiple regression as the test. The test assumed two tailed, H0 of 0, and 1 predictor (the EFT measure). Alpha was set at 0.05 and power was set at 0.95. The DV was level of detail. This analysis suggested 68 participants would be needed. 80 participants (63 female, 15 male, 1 other, 1 prefer not to say; M_{age} = 23.6 years, SD=11.1) participated in this online study. 63 were recruited via the university's research participation system and earned 1 course credit for participation. The remaining 17 participants were recruited via word of mouth and advertisements around the university campus and were not rewarded for participating.

Design

This study used a within-subject design with Veracity (truth vs. deceit) as the only within subjects' factor. All participants provided a truthful written statement of their plans for the weekend and a deceptive response to a mock wedding invitation in a counter balanced order. The dependent variables were the number of details and number of words participants used in participants' written accounts. There was no word limit set for participants' responses.

Materials

Participants completed the same EDT task (D'Argembeau et al., 2010; in written format) and MCQ (Johnson et al., 1988) as described in Study 1a. Participants also gave a written truthful and deceptive statement. In the truthful condition, participants were asked to write a paragraph about their intentions for the next weekend. In the deceptive condition, participants were provided with a mock wedding invitation. Participants were asked to imagine they had received the invitation from a cousin. They were asked to imagine that they were free to attend the wedding but were not on good terms with this family member and did not want to attend. We then asked participants to write a response to the invitation inventing a deceptive account of why they could not attend the ceremony. Participants were asked to imagine the scenario as realistically as possible and invent a plausible excuse (avoiding the fact that they do not like the cousin).

Procedure

Ethical approval was obtained from Lancaster University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants completed the study via the online survey platform Qualtrics. Participants first read a participant information sheet and signed a consent form. Participants then completed the EDT and corresponding MCQ, followed by the truthful and

deceptive statement (in a counterbalanced order). Participants then read a debrief form explaining the nature of the study. Participation took approximately 20 minutes.

Coding

Responses to the EDT task and the truthful and the deceptive statements were all coded using the same coding system as Study 1a (spatial, entity, sensory, thought/emotion/action and temporal; D'Argembeau et al., 2010). One coder rated 100% of participant responses and another coder rated of all three tasks. Inter-rater reliability for the sum of all details was excellent for the EDT Task: Intraclass Correlation Coefficient (ICC) = .99, 95% CI [.98, .99], the truthful statement: ICC = .99, 95% CI [.88, .99], and the deceptive statement: ICC = .98, 95% CI [.94, .99]. Participants provided very few sensory details in their truthful and deceptive statements therefore comparison in the ICC was not possible. See supplementary materials for the ICC for each individual coding classification for each of the three tasks.

Study 2a: Results

EFT ability and truth-telling and lying ability

Similar to Study 1a and supporting Hypothesis 4, truthful and deceptive statements provided by individuals with higher EDT scores contained more details and more words than those written by individuals with lower EDT scores (see Table 8.1).

Table 8.1

Linear regression - EDT scores predicting number of details and words in truthful and deceptive statements

		b	*SE*	*t*	*p*
Statement Details	Truthful	.15	.06	2.63	.010
	Deceptive	.09	.04	2.19	.032
Statement Words	Truthful	.41	.14	2.83	.006
	Deceptive	.27	.12	2.24	.028

Veracity

Unlike the veracity findings in Study 1a, there were no differences in the perceptual details given in the truthful (*M*=23.61, *SD=15.49)* versus deceptive statement (*M*=24.49, *SD=11.40, Z*=-.96, *p*=.335, *d*=-0.22), nor were there any differences in the number of words participants used in the truthful (*M*=62.54, *SD=39.32)* versus deceptive statement (*M*=66.88, *SD=32.65, Z*=-1.37, *p*=.169, *d*=-0.31). Therefore, Hypothesis 5 was not supported.

Study 2a: Discussion

Study 2a replicated the EFT findings from Study 1a in written format: in comparison to lower EFT individuals, higher EFT individuals used more details and words when describing truthful and deceptive accounts, supporting Hypothesis 1. Thus far, Studies 1a and 2a have shown that compared to participants with lower EFT ability, those with higher EFT ability provide more detailed and longer statements about both truthful and deceptive intentions in both verbal and written format. Study 1b found that deceptive verbal accounts provided by higher EFT individuals were judged as more credible than those provided by lower EFT individuals, suggesting a greater believability for higher EFT participants. Study 2b aimed to explore this effect with written accounts.

Study 2b: Purpose and Predictions

To further examine the relationship between EFT and truth-telling and lying ability (in written format), we presented the written truthful and deceptive accounts from Study 2a to a separate group of participants and asked them to rate the veracity of the accounts.

Hypothesis 6: Credibility

Based on the results from Study 1b, we predicted that participants with higher EFT ability would be judged as more credible in both veracity conditions than those with lower EFT ability.

Study 2b: Method

Participants

To ensure each written statement was judged by an observer at least 15 times, 102 participants (age and gender were not collected) were recruited via the university's research participation system and earned 2 course credits for participation. All 102 participants recruited for study 2b had not taken part in Study 2a.

Design

After collecting the written accounts from Study 2a, we realised that a substantial number of participants had explicitly referenced the wedding invitation in their deceptive accounts. To prevent the wedding reference acting as a cue to deception that was highly accurate, but not relevant to our hypothesis, we decided to use a between-subjects design for the current study, with half of the participants judging 24 truthful accounts and half of the participants judging 24 deceptive accounts. This also necessitated separate analysis for each condition as a cross condition analysis would not be valid. The dependent variables were the veracity judgment (binary response: Yes vs. No) and

participant's ratings of how much each cue influenced their veracity judgements. As the cue ratings are not relevant to the main hypotheses of this current paper, these ratings will not be further discussed.

Materials

160 (80 truthful, 80 deceptive) written accounts were derived from Study 2a. The truthful accounts included individuals describing their intentions for the weekend and the deceptive accounts comprised of individual deceptive responses to a mock wedding invitation. Participants were forced to answer each survey question, therefore all participants judged 24 written accounts.

Procedure

Ethical approval was obtained from Lancaster University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants completed the online questionnaire via the online survey platform Qualtrics. Participants first read a participant information sheet and then completed an online consent form. The survey program pseudo-randomly selected 24 (all truthful or all deceptive) written files for each participant. Participants were informed that they would be presented with 24 written accounts. In the truthful condition, participants were informed they would be presented with written accounts of individuals describing their plans for the weekend some of which would be truthful, and some of which would be deceptive. In the deception condition, participants were informed that they would be presented with responses to a wedding invite whereby individuals declined the wedding invitation using either truthful or deceptive reasons. After each statement (truthful and deceptive), participants rated the veracity of the account then rated the list of cues, indicating the extent to which each cue influenced their veracity judgement on a 7-point Likert scale (1:Did not influence my decision at all – 7: Significantly influenced my decision). The findings of the cues ratings are outside the scope of the hypotheses and will not be reported here. Upon completion of all ratings, participants read a debrief form explaining the nature of the study. Participation took approximately 20 minutes.

Data Analysis

To analyse the data, we fitted logistic multilevel models using the glmer function from the lme4 package in R (Bates et al., 2015). We created two datasets with one row of data for each veracity judgement to run the analyses on the truthfulness judgements. This comprised of 1119 rows in both the truthful and the deceptive dataset. When building up our models we used ANOVA to compare Akaike information criterion of the more simple and complex models. We ran Chi-square to test whether each more complex model was significantly better at explaining our data. The model with the lowest AIC value was chosen as the best fit to explain our data. Where two models did not

differ significantly, the model with the fewer predictors was considered better. All statistical tests were 2-tailed.

Study 2b: Results

We estimated a logistic multilevel model with EDT score as a fixed effect and random effects for Rater and Written Account. As hypothesised, EDT scores did predict truthfulness judgements in the truthful condition, β = 0.012, *SE* = 0.005, *z*=2.236, *p*=.019 and in the deceptive condition, β = 0.012, *SE* = 0.006, *z*=2.266, *p*=.024. In support of Hypothesis 6, higher EFT individuals were judged as more credible than lower EFT individuals, both when telling the truth and when lying.

Studies 2a and 2b: Discussion

Studies 2a and 2b were conceptual replications of Studies 1a and 1b in written format. Study 2a replicated the EFT findings from Study 1a (i.e., higher EFT individuals used more details and words when describing truthful and deceptive accounts, than lower EFT individuals), supporting Hypothesis 5. Study 2b replicated the findings from Study 1b in both veracity conditions (i.e., truthful and deceptive accounts given by higher EFT individuals were judged as more credible than accounts given by lower EFT individuals), supporting Hypothesis 6.

General Discussion

The results of the current four studies demonstrated a positive relationship between EFT ability and credibility in two ways. Firstly, higher (vs. lower) EFT individuals *generated* more credible accounts by providing longer and more detailed truthful and deceptive statements about future events in verbal format (Study 1a) and written format (Study 2a). Secondly, higher EFT individuals were *judged* as more credible when verbally describing their deceptive intentions (Study 1b) and writing true and false statements (Study 2b) compared to lower EFT individuals. The findings from all four studies suggest that EFT ability may be involved when credibly telling the truth and lying about intentions.

Our findings contribute to the developing work on the role of individual differences in credibility. Our results extend Vrij et al.'s (2010) characteristics of successful lie tellers by demonstrating that the ability to visualise future events affects the ability to tell the truth and lie about future events. Future research could explore the relationship between EFT ability and Vrij et al.'s (2010) characteristics associated with 'good liars' e.g., personality, behaviour, emotions, response to cognitive load and decoding skills. This would provide further insight into the mechanisms that are enabling higher EFT individuals to appear credible. The results from the current studies also demonstrated that EFT ability was linked to credibility characteristics across modalities

(spoken/written), supporting previous findings of consistency of credibility across modality (Bond et al, 2015). Future research should examine how higher EFT participants create and display this credible demeanour. It is likely that the high level of detail and high number of words play a role, as there is evidence that verbally skilled individuals may find the task of lying easier (Vrij et al, 2002; 2004) and interviewers perceive a lack of detail in accounts as less credible (Bogaard et al, 2016; Strömwall & Granhag, 2003). Furthermore, similar to the current studies, prior research has found truthful intentions to be longer in length (Sooniste et al, 2013) and contain more details (Warmelink et al, 2013) than deceptive intentions. However, prior research has shown non-verbal behaviours (e.g., perceived competence, composure, vocal and facial pleasantness, gaze aversion and postural shifts) influence judgements of credibility (Burgoon et al, 1990; Vrij et al, 2000; Zuckerman & Driver, 1985). Therefore, it is possible that higher EFT individuals exhibit more non-verbal behaviours associated with credibility than lower EFT individuals, as well as more credible verbal behaviour. Future research could explore this possibility.

Prior studies that have demonstrated a link between individual differences in various cognitive processes and deception ability focussed on past or current lies. This includes research on working memory capacity (Maldonado et al., 2018), counterfactual thinking (Briazu et al., 2017), and task switching ability (Atkinson, 2019). Our results extend this work by focussing on future lies and suggest that EFT ability may be an underlying cognitive process involved in making credible statements about intentions. However, it is unclear whether EFT is a cognitive process that contributes separately to working memory, counter factual thinking, and/or task switching ability or whether these skills are inter-related and jointly influence lying ability. Addis (2018; 2020), has suggested that memory and imagination are fundamentally the same process: constructive episodic simulation. It is possible that our results, as well Maldonado et al.'s (2018), all reflect the same relationship between constructive episodic simulation and credibility. Future research could explore this by examining whether EFT ability affects credibility when discussing past events or non-episodic topics (e.g., opinions or semantic knowledge). This would indicate whether EFT ability is specifically related to future events or represents a more general simulation ability.

In Study 1b, we found that, when lying, higher EFT individuals were perceived as more credible than lower EFT individuals and we replicated this finding across both veracity conditions in Study 2b. It is unclear why we found the EFT effect only in the deceptive condition in Study 1b, especially when participants rated truthful accounts as more plausible. It could be that participants found the truthful statement easier to make, which may have made it possible for lower EFT participants to appear as credible as higher EFT participants. All participants in Study 1a received specific instructions in the truthful condition, whereas participants were required to make up their

own cover story in the deceptive condition. Given free rein to construct a cover story may have led high EFT individuals to develop a more credible account than the limited options available in the instructed truthful condition. Future research could explore the effect of task instructions by asking participants to respond freely across veracity conditions. However, in Study 2a participants were given the fairly broad task of describing their plans for the weekend in the truthful condition, yet prescriptive instructions to respond to a mock wedding invitation in the deceptive condition. High EFT individuals' statements (versus lower EFT individuals' statements) were judged as more credible in both veracity conditions. Future thinking has been linked to creativity (e.g., Chiu, 2012; Förster et al, 2004). Recently, Thakral et al. (2021) found that individual differences in creative divergent thinking ability was associated with the ability to imagine future events (as measured by the amount of episodic details in the future account). It may therefore be the case that less restrictive instructions may allow high EFT individuals to be more creative, enabling them to provide more details of their future event which leads to them appearing more credible.

Our results also support previous work by D'Argembeau and Van der Linden (2006) and D'Argembeau et al. (2010), who found that there are individual differences in EFT ability. This further extends prior research demonstrating functional benefits of EFT in tasks such as decision making, problem solving, coping, goal processing and implementation intentions (Schacter et al., 2017; Szpunar, 2010) to social cognitive tasks. Previous EFT literature suggests there is a strong association between the forming of intentions and the formation of mental images (e.g., Szpunar, 2010). However, unlike Granhag and Knieps (2011), we found no difference between truth tellers and liars reporting of having activated a mental image whilst planning their truthful task (95%) or deceptive task (91%). This could have been due to the study design: Granhag and Knieps (2011) adopted a between-subjects design whereas the current study used a within-subjects design. It could be that as participants in the current study were interviewed twice by the same interviewer, they felt compelled to maintain consistency in their responses. It may also be a cultural/language difference. Granhag and Knieps (2011) study was conducted in Sweden in Swedish. The current study recruited participants in the UK and the study was delivered in English. Many participants in the current study were perplexed when asked if they formed a mental image when planning their task and asked the interviewer to explain what this meant. The framing of the question in Swedish (Granhag & Knieps, 2011 study) may have been simpler or less out of the ordinary compared to the framing of the question in English. The results also failed to support Granhag and Knieps (2011) findings of truth-tellers using more details and words when describing their mental image than liars. Our results replicate Knieps et al. (2013) who found no differences in the number of details or words used when describing truthful and deceptive mental images. It may be the case that veracity effects are more

salient in participants responses to their intentions and the planning of their intentions (Sooniste et al., 2013) rather than responses to questions about their mental images formed. Overall, future research may consider focussing on the description of an intention or the planning of an intention rather than mental images that are formed during these tasks. If researchers wish to pursue the mental image line of enquiry, participants should be briefed about the question and the concept should be explained in more detail.

Limitations

Despite, or perhaps due to, diverse areas of research investigating EFT (Brunette et al., 2018), there is currently no standardized measure of EFT. This brings into question whether the variety of EFT measures used in the literature are measuring a single underling construct of EFT or different aspects of EFT ability. Future research is needed to develop a valid, reliable and standardised measure of EFT. Such a measure could then be used to examine whether the many different skills that contribute to successful truth-telling or lying behaviour do so separately, or whether they jointly influence truth-telling and lying ability (O'Connell et al, *in prep*).

The EDT and the participants' statement were coded using a very similar coding system. This detail focussed coding system are possibly measuring some other skills besides EFT or lying ability (e.g., conscientiousness, descriptive ability or engagement with the task). Perceptual details are frequently used as a measure in future thinking tasks e.g., the autobiographical interview (Levine et al., 2002), the Memory Characteristics Questionnaire (Johnson et al., 1988), the Experiential Index (Hassabis et al., 2007), as well as a measure in truth-telling and lying behaviour (e.g., Warmelink et al., 2012; Warmelink et al., 2019; Warmelink & O'Connell, 2022). However, using this coding system across the different tasks in the current study (for ease of comparison) may have increased the risk that some unknown confound affected participants' scores on all tasks, creating a spurious correlation.

Study 1a was conducted in the laboratory, Study 1b and Studies 2a and 2b were completed online and therefore not necessarily reflective of a realistic environment or high stakes situation. Whilst the majority of deception research adopts low-stakes deception protocols (for practical and ethical considerations), the EFT and credibility relationship may be different in a high-stakes lie scenario. Also, by adopting a within-subject design, it is possible that participants being intercepted twice in the same experiment (truthful and deceptive conditions) may have affected how they planned their second task and responded to questions in the second interview.

Conclusion

Our findings contribute to the developing work on the role of individual differences in truth-telling and lying behaviour. Our results suggest that EFT ability is associated with credibility when truth-telling and lying.

Appendix B

Intentions Tasks

Truthful Tasks

Task A

This task will require you to go to a shop of your choice (on campus) and buy two gifts for a friend to the value of £20. You will be given 5 minutes to plan your task. After this you will be given £20 and asked to go and carry out your task and return to this room. Please remember to get a receipt for your purchase and bring this back with you. You only have one chance to carry out this task and a short amount of time to complete the task. You are supplied with a map of the campus to help you plan your task and carry it out swiftly. On return, you will be interviewed about your task, could you please be honest when answering questions.

To ensure understanding, please briefly write down what you are about to do next.

Task B

This task will require you to go to the Base to collect 2 small boxes of flyers and bring them back to this room. These are charity information flyers, there are a number of different charities offering these but please only choose two. You only have one chance to carry out this task and a short amount of time to complete it. You are supplied with a map of the campus to help you plan your task and carry it out swiftly. You will be given 5 minutes to plan your task. On return, you will be interviewed about your task, could you please be honest when answering questions.

To ensure understanding, please briefly write down what you are about to do next.

Task C

This task will require you to go to any takeaway food shop on campus and buy lunch for 4 people - spending no more than £20. You will be given 5 minutes to plan your task. After this you will be given £20 and asked to go and carry out your task and return to this room. Please remember to get a receipt for your purchase and bring this back with you. You only have one chance to carry out this task and a short amount of time to complete the task. You are supplied with a map of the campus to help you plan your task and carry it out swiftly. On return, you will be interviewed about your task, could you please be honest when answering questions.

To ensure understanding, please briefly write down what you are about to do next.

Task D

This task will require you to go to the Spar shop on campus to buy some snacks for a psychology event involving 17 students. You will be given £20 to buy snacks of your choice, please remember to bring back the receipt. You will be given 5 minutes to plan your task. You only have one chance to carry out this task and a short amount of time to complete the task. You are supplied with a map of the campus to help you plan your task and carry it out swiftly. On return, you will be interviewed about your task, could you please be honest when answering questions.

To ensure understanding, please briefly write down what you are about to do next.

Task E

This task will require you to go the Base and purchase 2 event tickets offered by the student union (clubs and society) and bring them back to this room. The type of event ticket is your choice but the cost must not exceed £20. Please remember to bring the receipt for the ticket purchase back with you. You will be given 5 minutes to plan your task. You only have one chance to carry out this task and a short amount of time to complete the task. You are supplied with a map of the campus to help you plan your task and carry it out swiftly. On return, you will be interviewed about your task, could you please be honest when answering questions.

To ensure understanding, please briefly write down what you are about to do next.

Deceptive Task

Task F

This task will require you to place a memory stick containing illegal material on a shelf in the library on campus. The memory stick must be placed in the Physics (B) aisle, specifically in the Quantum Physics area. Please place the memory stick in between the two books 'Nuclear reactions' and 'Understanding Quantum Mechanics' – both library code BFJ(A) in the third row down from the top. It is unlikely someone will find the memory stick by mistake in this area of the shop. You will be given 5 minutes to plan your task. You only have one chance to carry out this task and a short amount of time to complete the task. You are supplied with a map of the campus to help you plan your task and carry it out swiftly. **Please plan a cover story to mask your real guilty intention in case you are intercepted. The interviewer does not know your true intention therefore it is your job to convince them that your cover story is true.**

To ensure understanding, please briefly write down what you are about to do next.

Appendix C

Interview Questions

- ‘What is the task you are about to carry out?’,
- ‘I want you to tell me about your intentions for task (a/b/c/d/e/f). Please tell me about each and every step – and try to be as detailed as possible’
- ‘How long will task A/B take?’
- ‘Where do you intend to go first?’
- ‘Where else do you intend to visit in Lancaster University?’
- ‘Did you, at any point during your planning, evoke a mental image of the future event?’
- ‘Can you please describe the most dominant mental image in as much detail as possible?’
- ‘Is there anything else you can remember about this mental image?’

Appendix D

Study 1a Post Interview Questionnaire

Truthful Condition

Below, you will be asked a series of questions about the event you have described. Please answer each one of the questions using the 7-point scale that is included by circling the appropriate number.

How truthful were you during the interview?

Everything I told was true — Everything I told was a lie

1 2 3 4 5 6 7

How difficult did you find the planning of your task?

Very easy — Very difficult

1 2 3 4 5 6 7

How sufficient was the time given to plan your task (5 minutes)

Not at all sufficient — Totally sufficient

1 2 3 4 5 6 7

How satisfied were you with the planning?

Not at all satisfied — Very satisfied

1 2 3 4 5 6 7

How interesting did you find the planning?

Not at all interesting — Very interesting

1 2 3 4 5 6 7

Now please think back to your planning of the task (truthful condition) / cover story (deceptive condition),

To what extent did you form a mental image while planning your errand (truthful condition) / cover story (deceptive condition)?

To a very low extent — To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by visual detail?

To a very low extent — To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by sound?

To a very low extent — To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by smell/taste?

To a very low extent — To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by touch?

To a very low extent — To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by the spatial location of objects?

To a very low extent To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by the spatial location of people?

To a very low extent To a very high extent

1 2 3 4 5 6 7

To what extent was your dominant mental image characterised by the temporal order of the event?

To a very low extent To a very high extent

1 2 3 4 5 6 7

To sum up, how clearly did you pre-experience the future event?

To a very low degree/ No strong feeling of pre-experience

To a very high degree/ Very strong feeling of having pre-experienced

1 2 3 4 5 6 7

During your interview you was asked 'Did you, at any point during your planning evoke mental image of an event?' To what extent did you find this difficult to answer?

Not at all difficult Very difficult

1 2 3 4 5 6 7

Appendix E

Table 9.1

Coding Categories for the EDT task, intentions descriptions and mental image descriptions

Category	Category description
Spatial	Any reference to the position of an entity, direction, or spatial measurements (e.g., 'next to', 'in front', 'south of').
Entity	Objects, people, animals (e.g., 'surf board', 'my partner', 'the dog').
Sensory	References to touch, taste, smell, sound, sight as well as weather and atmosphere references (e.g., 'the ground was *hot*', '*tasted* of coconut', '*smell* of the sea').
Thought/ emotion	Introspective thoughts, emotions intentions of the participant or others in the described scene (e.g., 'I felt happy', 'calming', 'excited').
Action	Actions of the participant or anyone else described in the scene (e.g., 'I am *surfing'*, I will *walk* to the library', 'I will *pick up* some snacks').
Temporal	Any temporal (i.e., time) context or measurement ('My flight leaves at *12pm*', 'I will stay for *one hour*', the journey takes *two hours*').

Appendix F

Table 10.1

ICC for individual coding classification for EDT, truthful and deceptive statement (Study 2a)

Task	Perceptual Category	ICC	95% CI
EDT Task	Spatial	.967	.854, .985
	Entity	.971	.929, .989
	Sensory	.951	.877, .980
	Thought/Emotion/Action	.966	.832, .984
	Temporal	.838	.407, .923
Truthful Statement	Spatial	.906	.758, .961
	Entity	.972	.931, .989
	Sensory	.000	-1.374, .594
	Thought/Emotion/Action	.954	.556, .976
	Temporal	.903	.758, .961
Deceptive Statement	Spatial	.778	.453, .914
	Entity	.875	.506, .940
	Sensory	.000	-1.526, .604
	Thought/Emotion/Action	.920	.665, .962
	Temporal	.942	.857, .977

Appendix H

Table 11.1

Results for comparison between paid (N=32) and unpaid (N=61) participants in Study 1a

		M	*SD*	*t*	*p*
Intentions Details Truthful	Credits (N=61)	37.13	26.80	.231	.818
	Financial (N=32)	35.69	31.86		
Intentions Words Truthful	Credits (N=61)	76.77	53.99	.855	.395
	Financial (N=32)	67.19	45.87		
Intentions Details Deceptive	Credits (N=61)	31.72	16.22	1.053	.295
	Financial (N=33)	27.30	24.30		
Intentions Words Deceptive	Credits (N=61)	60.03	29.38	.672	.503
	Financial (N=33)	54.70	47.57		
Mental Image Details Truthful	Credits (N=57)	27.72	19.88	.131	.896
	Financial (N=32)	27.13	21.59		
Mental Image Words Truthful	Credits (N=57)	64.51	46.02	.270	.788
	Financial(N=32)	61.63	52.28		
Mental Image Details Deceptive	Credits (N=55)	25.35	18.52	.055	.956
	Financial (N=29)	25.10	20.04		
Mental Image Words Deceptive	Credits (N=55)	56.71	40.60	.370	.713
	Financial (N=29)	53.24	41.42		

Chapter 5: The effect of Episodic Future Thinking ability on subjective cue use when judging credibility

Abstract

Background

Episodic Future Thought (EFT) ability affects how credible individuals appear (O'Connell et al., under review). However, it is unclear how individuals with higher EFT ability create this credible demeanour. This paper describes two studies that explored participants' subjective cue use when judging the veracity of verbal statements (Study 1) and written statements (Study 2) provided by individuals with varying EFT ability.

Method

In Study 1, 68 participants judged the veracity and indicated which cues influenced their veracity judgements of six truthful and six deceptive verbal statements. In Study 2, 102 participants judged the veracity and indicated which cues influenced their veracity judgements of 24 truthful or 24 deceptive written statements.

Results

Study 1 and Study 2 showed that the EFT ability of the sender affected subjective cue use. In Study 1, participants were influenced by different subjective cues when judging truthful (vs. deceptive) verbal statements. In Study 2, participants reported being influenced by the same cues in both veracity conditions. Study 1 showed that three cues mediated the relationship between EFT ability and veracity judgements. In Study 2, four cues mediated the EFT ability – veracity judgement relationship in the deceptive condition. There were no mediation effects in the truthful condition.

Conclusion

We propose that EFT ability is an underlying cognitive mechanism involved in creating a credible demeanour which can affect participants' veracity judgements. The current results suggest that the cues present in higher EFT individual's accounts may be contributing to this credibility effect.

Keywords

Episodic Future Thought, Future Thinking, Deception, Lying, Cues

Introduction

Deception research has examined both objective and subjective cues to deceit. Objective cues are observable cues related to lying behaviour, including verbal (e.g., details and plausibility) and non-verbal (e.g., nervousness and tension; DePaulo et al., 2003). Subjective cues to deception are cues that an observer directs (or believes they direct) their attention to when judging veracity, e.g., gaze aversion, fidgeting, higher voice pitch and speech errors (Caso et al., 2018; Hartwig & Bond, 2011; Wright Whelan et al., 2014). Subjective cues are not necessarily consistent with objective cues in the literature (Amado et al, 2016; Bond & DePaulo, 2006; Strömwall et al., 2004; Vrij et al., 2011). People report using different cues when they believe that the sender is lying than when they believe the sender is telling the truth (Bogaard et al., 2016). Cues that individuals report as influencing their lying judgements include low plausibility and coherence, low perceptual information, fewer unusual details, low cognitive operations, fewer descriptions of emotions, interactions and speech reproductions (Bogaard et al., 2016; Hartwig & Bond, 2011). Cues that influence truth judgements include more details and repetitions, consistency, fewer contradictions, and fewer omissions (Hudson et al., 2020).

People vary in their ability to tell the truth and lie credibly (Bond & DePaulo, 2008; O'Connell et al., under review; Vrij et al., 2010). Whether people can appear credible consistently across situations is under debate. Bond et al. (2015) found that participants who looked honest also sounded honest and their written transcripts also appeared more honest. Stimuli medium presentation affects veracity accuracy (Bond & DePaulo, 2006); therefore this consistency suggests that credible demeanour is trait-like, or dependent on an underlying cognitive skill or mechanism. However, Levine et al. (2011) argue that whilst sender demeanour is an individual difference, there may be situational variations and trait-by-situation interactions in sender demeanour. It is unclear what processes or mechanisms enable an individual to appear honest when lying in different situational contexts and across different mediums.

Episodic future thought

To distinguish between truthful and deceptive intentions, researchers have adopted approaches relating to goals (Ask et al., 2013); planning (Sooniste et al., 2013), and mental imagery (Knieps et al., 2013). These approaches are based on the premise that forming intentions involves a degree of planning to achieve a particular goal, and these processes may be accompanied by mental images when forming future events (Szpunar, 2010).

EFT is the ability to pre-experience future events in one or several mental visual images (Szpunar, 2010). People use EFT in decision making, problem solving, coping, goal processing, and implementation intentions (Schacter et al., 2017). People vary in their ability to construct detailed mental representations of future events (D'Argembeau & Van der Linden, 2006), and individual differences in executive functioning affects the quantity and quality of episodic details provided when describing specific future events (D'Argembeau et al, 2010; Hill & Emery, 2013). EFT also appears to play a role in deception. Truth-tellers report evoking a mental image to a greater extent than liars and provide richer descriptions of their mental image than liars (Granhag & Knieps, 2011; Knieps et al., 2013a; Knieps et al., 2013b). These findings suggest that truth-tellers may be engaging in EFT more than liars. It is possible that individuals with higher EFT ability i.e., those who utilise more perceptual information (e.g., visual and sensory details) when imagining future events use these perceptual markers when generating truthful and deceptive intention statements. This may lead to these individuals appearing more credible than those who are unable to draw on such resources, i.e., those with lower EFT ability. O'Connell et al. (under review) tested this assumption via a series of studies. The results showed that participants with higher EFT ability provided longer and more detailed statements than those with lower EFT ability, both when writing and when speaking. Participants with higher EFT ability were judged as more credible when lying in their spoken statements and more credible in truthful and deceptive written accounts than those with lower EFT ability. The current studies explore what subjective cues people report as influencing their veracity judgements when rating truthful and deceptive verbal and written statements provided by individuals with varying EFT ability.

Current Research

To examine how subjective cue use influenced participants veracity judgements and how these were affected by the EFT ability of the sender, we conducted two studies in which participants judged the veracity of truthful and deceptive verbal statements (Study 1) and truthful and deceptive written accounts (Study 2). The decision to use audio and written stimuli (rather than video stimuli) was influenced by two factors. Firstly, prior research has found people to be less accurate when judging video-only stimuli (Bond & DePaulo, 2006). Several hypotheses have been proposed to explain this modality effect. The distraction hypothesis posits that the presence of non-verbal cues (i.e., in video stimuli) distracts observers from attending to the verbal content of a message thus increasing the difficulty of identifying truthful verbal indicators (Bauchner et al., 1977; Maier & Thurber, 1968). The information overload hypothesis suggests that the increased cognitive load from processing all incoming information may lead to observers missing important truthful and deceptive

cues (Bauchner et al., 1980; Miller et al., 1981; Stiff et al., 1989). Stiff et al. (1989) demonstrated partial support for the situational familiarity hypothesis. This posits that in familiar situations observers use verbal cues only as they are able to assess the validity of the verbal content. In unfamiliar situations, where observers are unable to assess the validity of the verbal cues, they utilise nonverbal cues or cultural expectations (heuristics) in decision making. Secondly, as the lie-tellers and judges in the current study were university students from the same cohort, it was decided for ethical reasons to use anonymised media. Participants rated the extent to which various cues influenced their veracity judgements. The statements were provided by individuals with varying EFT ability in a previous study (O'Connell et al., under review; see https://osf.io/bpkf3/?view_only=6a3e26159699465dbccdd09b66d1cf3f). In Study 1, participants judged the veracity of verbal statements and completed a cues checklist, indicating the extent to which each cue influenced their veracity judgement. Study 2 was a conceptual replication of Study 1 whereby participants judged the veracity of truthful and deceptive written statements and rated the extent to which various cues influenced their veracity judgements. In both studies, we examined whether the EFT ability of the sender influenced subjective cue use when judging the veracity of the statements. Study 1 was pre-registered (https://osf.io/987wp/?view_only=9f1a05cf39ce40aa9dca8c48859669c6). Study 2 was not pre-registered as the original data (written statements) was collected at a later timepoint and for a different purpose i.e., to explore the relationship between EFT ability and credibility of written accounts. We then decided to use these written statements to explore subjective cue use when judging veracity and look at the findings in relation to subjective cue use when judging verbal accounts (Study 1).

Study 1: Aims and Hypotheses

As in the pre-registration, we aimed to replicate O'Connnell et al's. (under review) findings that sender's EFT ability predicts perceived veracity (Hypothesis 1). We also aimed to explore which subjective cues influenced participants' veracity judgements when listening to statements given by people with varying EFT ability. We predicted that subjective cue use would be influenced by the EFT ability of the sender (Hypothesis 2). Based on the findings from previous studies (Bogaard et al., 2016; Hudson et al., 2020), we expected participants to be influenced by different subjective cues when judging truthful (vs. deceptive) statements (Hypothesis 3). Finally, we predicted that subjective cue use would mediate the relationship between sender's EFT ability and perceived veracity (Hypothesis 4).

Study 1: Method

Participants

G*power was used to conduct an a priori power analysis, using the exact test family and a linear multiple regression as the test. The test assumed two tailed, H0 of 0, and one predictor (the EFT measure) and level of detail as the DV. Alpha was set at 0.05 and power was set at 0.95. This analysis did not include random effects for the multilevel analysis, lowering the overall power from 0.95. The analysis suggested 68 participants would be needed. 68 participants (60 female, 8 male) aged between 18 years old and 33 years old (M_{age}=18.60 years, *SD*=1.86) were recruited via the University's research participation system. Participants earned two course credits for participation. Each participant judged 12 verbal statements; in line with Levine et al.'s (2022) recommendations to have a large number of judgements per judge.

Design

The study used a within-subjects design where participants judged the veracity (truth vs. lie) of statements from individuals with high (highest 15%) vs. medium (median 15%) vs. low (lowest 15%) EFT ability. The survey program pseudo-randomly selected 12 verbal statements for each participant to rate (six truthful statements and six deceptive statements). Participants were informed they would be presented with 12 audio clips but not how many were truthful versus deceptive. In each veracity condition, two statements were from individuals with low EFT ability, two from individuals with medium EFT ability, and two from individuals with high EFT ability. The dependant variables were the veracity judgment: 'do you believe this individual is telling the truth?' (Yes vs. No), and participants' ratings of the extent to which each of the 18 cues influenced their truthfulness judgement, on a 7-point scale from 1 (did not influence my decision at all) to 7 (significantly influenced my decision).

Materials

The materials consisted of 90 verbal statements of individuals describing their truthful or deceptive intentions. These statements were collected in a previous study (Study 1a; O'Connell et al., under review), which measured EFT ability using an Episodic Details Task (D'Argembeau et al., 2010). This task required participants to describe a specific, plausible, and new event that they may encounter on their next holiday. Participants completed both a truthful and a deceptive intentions task in a counter balanced order. In the truthful condition, participants were asked to plan one of five tasks (e.g., buying two gifts for a friend for £20) and were advised that if they were intercepted whilst completing their task, to answer any questions truthfully. Five truthful tasks were created to ensure the interviewers were blind to the veracity of the tasks. In the deceptive condition, participants were asked to plan a mock criminal task (i.e., plant a USB stick containing 'illegal'

material in a library). Participants in the deceptive condition were also told to plan a cover story and to use this cover story if they were intercepted and asked questions about their intentions. All participants were provided with a map of the university campus and were informed that they only had one chance and a short amount of time to complete the task. All participants were left for five minutes to plan their task. The researcher confirmed that the participants understood their task and reminded deceptive participants to use their cover story if they were intercepted and asked questions about their intentions. All participants were informed that if they were intercepted and asked questions about their task, the interviewer would not know whether they are telling the truth or lying and that they should try to convince the interviewer that they were telling the truth. As a manipulation check, before leaving the room, participants were asked to briefly write down what they were about to do next: all participants passed. Participants were intercepted before carrying out their tasks and interviewed. During the interview, participants were asked to describe their intentions in as much detail as possible. Participant's verbal descriptions of their truthful and deceptive intentions provide the stimulus material for the current study (please see Table 12.1 and Table 12.2 in supplementary materials). Each statement was judged by between eight and ten participants.

The cues checklist was derived from a pilot study (see https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8 for full pilot study) in which 31 participants judged the veracity of six verbal statements (from the same set of statements used in the current study) and reported the reasons they believed the individual was telling the truth or lying in as much detail as possible (open responses). The eight most frequently cited cues were combined with 10 cues used in the deception literature (Akehurst et al., 2018; Evans et al., 2013; Lev-Ari & Keysar, 2010; Vrij, 2008) to create an 18 cues checklist for the current study. Participants completed the cues checklist, indicating the extent to which each of the 18 cues influenced their veracity judgements (see Table 13.1 supplementary materials for cues list).

Procedure

Ethical approval was obtained from the University's Faculty of Science and Technology Research Ethics Committee (FSTREC). The survey was completed via the online survey platform Qualtrics. Participants accessed the study via an online link on the university's research participation system. Participants first read a participant information sheet and then gave online consent by clicking each statement on a consent form. Participants were informed that they would be presented with 12 statements which would involve individuals describing themselves carrying out a specific task. After listening to each statement, participants were asked whether they believed the

individual was telling the truth (Yes vs. No), and then they were asked to rate 18 cues (e.g., level of detail), indicating the extent to which each cue influenced their veracity judgement. Upon completion of the study, participants read a debrief form explaining the nature of the study. Participation took approximately 25 minutes.

Data Analysis

To explore the relationship between participants' subjective cue use, we calculated participants' mean responses for each cue and carried out a Pearson Correlation on these mean responses (see Table 14.1). We initially ran single mediator SEMs (i.e., EFT Ability→Cue→ Veracity Judgement; Table 15.1). Due to participants' cue ratings significantly correlating (Table 14.1), the cues used in the single mediator SEMs that demonstrated a significant indirect path (unnecessary details, logical order and nervous) were then combined in a multiple mediator SEM model. To test if the EFT ability of the sender, and whether each cue predicted veracity judgements (Hypotheses 1 and 3), we fitted generalised linear mixed effects models using the glmer function from the lme4 package in R (Bates et al., 2015). To assess whether the EFT ability of the speaker affected subjective cue ratings (Hypothesis 2) we fitted linear mixed effects models using the lmer function from the lme4 package in R (Bates et al., 2015). As the Piecewise SEM package (Lefcheck, 2015) does not support the clmm function for ordinal data, we treated the cues data as continuous (Johnson & Creech, 1983; Norman, 2010; Sullivan & Artino, 2013; see Table 16.1 (in supplementary materials) for results of EFT ability predicting subjective cue use using the CLMM function of the Ordinal package; Christensen, 2019; see Supplementary Tables for R^2 regression results for LMER and CLMM models on https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8). We included random effects of Participant (Rater) and Statement (Audio) in each model. All statistical tests were 2-tailed.

All data and code have been made available at [Open Science Framework] and can be accessed at [https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8]. These analyses differ substantially from the analyses preregistered at (https://osf.io/987wp/?view_only=9f1a05cf39ce40aa9dca8c48859669c6). The analyses presented here are a more suitable way to address the hypotheses. [2] Accuracy rates by sender can also be found on the OSF project page.

Study 1: Results

Table 14.1 shows the Means, Standard Deviations, and Correlations of participants ratings of the 18 cues. The results from the single mediator SEMs are shown in Table 15.1 (in supplementary

[2] We would like to thank reviewer 2, who suggested these analyses and the R package used.

materials) and the results for the multiple mediator SEM are shown in Figure 3.1. As shown in Figure 3.1, EFT ability did not predict the likelihood that the statement was rated as true (.001 [-.011, .012]). Table 17.1 shows that after adjusting p values for multiple comparisons, EFT ability predicted subjective cue ratings of one cue: unnecessary details (<.0001 [.004, .013]). Table 15.1 shows that when participants rated accounts as true, the participants' rated the following cues as influencing their decision to a higher extent: the interviewee's accent (.012 [.003, .022]), made sense (.044 [.034, 0.56]), logical order (.051 [.042, .064]), flowed naturally (.025 [.016, .035]), and plausible (.061 [.050, .076]). When participants rated accounts as deceptive, participants reported the following cues as influencing their decision to a greater extent: pauses (-.034 [-.045, -.024]), details (-.011 [-.020, -.002]), contradictions (-.022 [-.032, -.012]), unnecessary details (-.026 [-.036, -.017]), filler words (-.042 [-.054, .032]), repeated words (-.028 [-.038, -.019]), rehearsed (-.030 [-.040, .021]), nervousness (-.042 [-.054, -.033]), hesitance (-.044 [-.056, -.034]), and think hard (-.034 [-.045, -.025]). These results show that different cues influence participants' truthful (vs. deceptive) judgements. The results of the SEM also showed that three cues mediated the relationship between EFT ability and veracity judgements: unnecessary details, logical order and nervousness (indirect effect = -.008 [-.009, -.003]).

Table 14.1

Means, Standard Deviations and Pearson Correlations of Participants Mean Ratings for each of the 18 cues in Study 1

Cue	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.Accent	2.04	1.26																	
2.Pitch	3.40	1.43	.57**																
3.Pauses	4.27	1.13	.34**	.46**															
4.Details	5.15	.95	.14	.13	.55**														
5.Contradictions	2.78	1.24	.15	.22	.51**	.34**													
6.Emotion	3.67	1.43	.22	.46**	.51**	.36**	.52**												
7.Unnecessary Details	3.91	1.24	-.02	.11	.48**	.57**	.62**	.48**											
8.Filler Words	3.91	1.37	.14	.24*	.77**	.50**	.69**	.52**	.67**										
9.Repeated Details/Words	3.18	1.37	.18	.25*	.65**	.47**	.80**	.58**	.69**	.84**									
10.Made Sense	5.01	.84	.15	.20	.34**	.55**	.48**	.22	.40**	.37**	.45**								
11.Logical Order	4.94	.89	.09	.19	.29*	.58**	.37**	.21	.35**	.28*	.41**	.87**							
12.Flowed Naturally	5.22	.82	.09	.21	.40**	.51**	.21	.34*	.31**	.34**	.32**	.31*	.62**						
13.Plausible	4.96	.94	.13	.16	.19	.51**	.24*	.22	.21	.32**	.21	.28*	.77**	.86**					
14.Rehearsed	4.21	1.32	.05	.17	.41**	.50**	.50**	.30*	.64**	.58**	.55**	.45**	.43**	.59**	.38**				

15.Hesistant	4.21	1.26	.14	.22	.54**	.49**	.55**	.44**	.63**	.72**	.68**	.40**	.41**	.55**	.39**	.78**			
16.Nervous	4.13	1.35	.11	.21	.48**	.43**	.51*	.47**	.58**	.68**	.66**	.37**	.35**	.48**	.33**	.72**	.94**		
17.Think Hard	4.12	1.31	.10	.20	.49**	.46**	.58**	.43**	.67**	.71**	.66**	.33**	.35**	.47**	.31*	.78**	.88**	.84**	
18.Spontaneous Corrections	3.14	1.42	.25*	.28*	.52**	.35**	.84*	.47*	.64**	.70**	.78**	.59**	.49**	.42**	.38**	.63**	.71**	.66**	.70**

Table 17.1

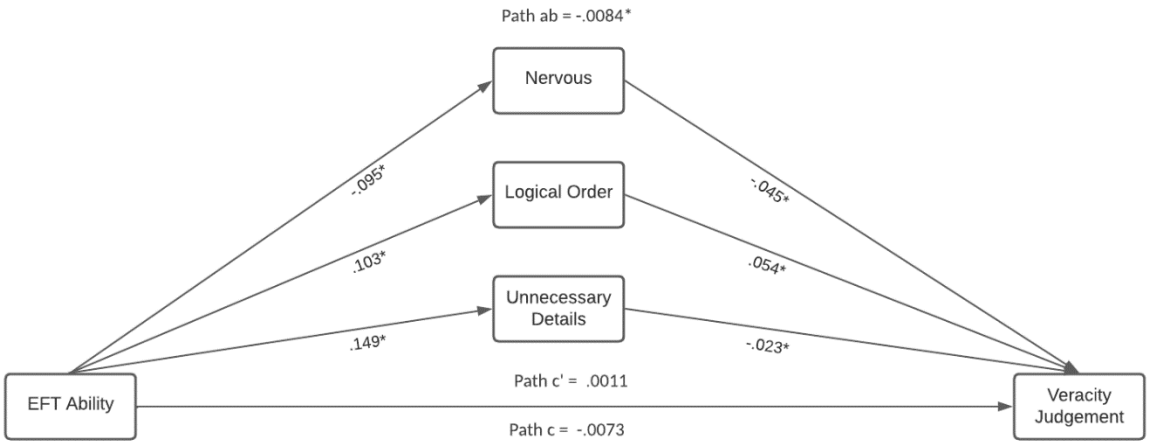
Study 1 Linear regression table for EFT ability predicting subjective cue use

	Coefficient	*SE*	*t*	*p*	*Adjusted p*	95% CI
M1 Accent	-.001	.001	-.741	.46	.946	-.003, .002
M2 Pitch	-.001	.001	-.723	.472	.946	-.004, .002
M3 Pauses	<.0001	<.0001	.154	.878	.946	-.004, .004
M4 Details	<.0001	<.0001	2.448	.0165*	.248	.001, .007
M5 Contradictions	.002	.001	1.227	.205	.946	-.001, .005
M6 Emotion	.003	.002	1.704	.0923	.946	<-.001, .006
M7 Unnecessary Details	<.0001	<.0001	3.555	.000618***	.011*	.004, .013
M8 Filler Words	<.0001	<.0001	.699	.486	.946	-.003, .005
M9 Repeated Words	<.0001	<.0001	.371	.712	.946	-.003, .005
M10 Made Sense	<.0001	<.0001	1.886	.0628	.816	<-.001, .006
M11 Logical Order	<.0001	<.0001	2.492	.0147*	.235	.001, .007
M12 Flowed Naturally	<.0001	<.0001	2.076	.041*	.574	<.001, .006
M13 Plausible	<.0001	<.0001	.068	.946	.946	-.003, .004
M14 Rehearsed	-.002	.002	-1.366	.185	.946	-.006, .001
M15 Hesitant	-.004	.002	-1.726	.088	.946	-.008, .001
M16 Nervous	-.005	.002	-2.883	.00501**	.085	-.009, -.002
M17 Think Hard	<-.001	.002	-.177	.86	.946	-.004, .003
M18 Spontaneous Corrections	<.0001	<.0001	1.444	.152	.946	-.001, .007

**p <.05. **p <.01. ***p <.001.*

Figure 3.1

*Unstandardised coefficients for the effect of EFT ability on veracity judgements mediated by the cues unnecessary details, logical order and nervousness. 1000 bootstrapped samples. *p <.05.*



Study 1: Discussion

The results from Study 1 failed to demonstrate an effect of EFT ability on veracity judgements, therefore Hypothesis 1 was not supported. Hypothesis 2 was partially supported, the higher the EFT ability of the sender, the more the cue unnecessary details affected participants' veracity judgements. As predicted in Hypothesis 3, participants were influenced by different subjective cues when judging truthful (vs. deceptive) verbal statements, supporting Bogaard et al. (2016), Hartwig and Bond (2011), and Hudson et al. (2020). Findings from the SEM analysis showed that the effect of the EFT ability of the sender on participants' veracity judgements was partially mediated by the cues unnecessary details, logical order and nervousness, partially supporting Hypothesis 4.

Study 2: Aims and Hypotheses

Study 2 was a conceptual replication of Study 1, based on written instead of spoken statements. Similar to Study 1, we expected sender's EFT ability to predict perceived veracity (Hypothesis 5), and that the EFT ability of the sender would affect subjective cue use (Hypothesis 6). We expected that reported cue use would predict veracity judgements in both the truthful and deceptive conditions (Hypothesis 7), and that subjective cue use would mediate the sender's EFT ability and perceived veracity relationship (Hypothesis 8).

Study 2: Method

Participants

Sample size was determined by the number of observer ratings (e.g., Levine et al., 2022): each written statement was judged at least 15 times. 103 participants were recruited via the University's Research Participation System. Each participant earned two course credits for their participation in the study.

Design

O'Connell et al. (under review; Study 2a) used two different tasks to create the truthful and the deceptive statements. For the truthful task, participants described their plans for the weekend, and for the deceptive task they wrote a deceptive response to a mock wedding invitation. After collecting the written statements in this study, it became apparent that a large proportion of participants had referenced to the wedding invitation. To prevent these responses from acting as a (correct, but not meaningful) cue to deception, a between-subjects design was used whereby half of the participants judged 24 truthful written statements and half of the participants judged 24 deceptive written statements from individuals with varying EFT ability, again measured using the EDT. The dependent variables were veracity judgment (Yes vs. No) and participants' ratings of the extent to which each of the eight cues influenced their truthfulness judgement on a 7-point scale from 1 (did not influence my decision) to 7 (significantly influenced my decision). As the truthful and deceptive tasks were very different, this necessitated separate analysis for each veracity condition as a cross condition analysis would not be valid.

Materials

160 (80 truthful, 80 deceptive) written statements were derived from Study 2a in O'Connell et al. (under review). The truthful statements included individuals describing their intentions for the weekend and the deceptive statements comprised of individual deceptive responses to a mock wedding invitation (see Table 1). The cues list was adapted from Study 1 as the stimuli used in the current study were written statements. Cues relating to verbal characteristics (i.e., accent, pitch of voice, filler words, rehearsed, flowed naturally, hesitance, nervousness, think hard and spontaneous corrections) were removed. This resulted in a list of eight cues for the current study: details, contradictions, emotion, unnecessary details, repeated words, made sense, logical order, and plausible.

Procedure

Ethical approval was obtained from the University's Faculty of Science and Technology Research Ethics Committee (FSTREC). The survey was completed via the online survey platform Qualtrics. Participants read a participant information sheet and then gave online consent by clicking

each statement on a consent form. The survey program pseudo-randomly selected 24 (truthful or deceptive) written statements for each participant. Participants were informed beforehand about the number of statements they would be asked to rate. In the truthful condition, participants were informed they would be presented with written accounts of individuals' plans for the weekend some of which would be truthful, and some would be deceptive. In the deceptive condition, participants were informed that they would be presented with written responses to a wedding invite, whereby individuals declined the wedding invitation using truthful or deceptive reasons. Participants were unaware that all the statements presented to them were from the same veracity condition. After each statement, participants rated the veracity of the account (Yes vs. No), then rated the list of eight cues indicating the extent to which each cue influenced their veracity judgement. Upon completion of the study, participants read a debrief form. Participation took approximately 20 minutes.

Data Analysis

The same SEM analyses process were carried out as in Study 1. As in Study 1, the cue ratings were treated as continuous data, see Table 18.1 (supplementary materials) for results of ordinal regressions using the CLMM function (see https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8 for R^2 regression results for LMER and CLMM models). Results from the single mediator SEMs are shown in Table 19.1 (truthful condition) and Table 19.2 (deceptive condition) in the supplementary materials. The cues from the single mediator models that demonstrated a significant indirect effect on EFT ability and veracity judgements were then combined in a multiple mediators SEM model (Figure 4.1 and Figure 4.2). Accuracy rates by sender can also be found on the OSF project page.

Study 2: Results

Tables 20.1 and 20.2 show the Means, Standard Deviations, and Correlations of participants ratings of the eight cues in the truthful and deceptive condition. The results from the SEM are shown in Figure 4.1 (truthful condition) and Figure 4.2 (deceptive condition). As shown in these figures, EFT ability significantly predicted veracity judgements in the truthful condition (.016 [.003, .031]), and the deceptive condition (.018 [.004, .034]). Table 21.1 shows that after adjusting p values for multiple comparisons, in the truthful condition, EFT ability predicted subjective cue ratings of three cues: emotion (.009 [.003, .015]), unnecessary details (.010 [.003, .017]), and made sense (.005 [.002, .019]). In the deceptive condition, EFT ability predicted subjective cue ratings of five cues: unnecessary details (<.0001 [.006, .019]), repeated words (.007 [.002, .012]), made sense (<.0001 [.002, .011]), logical order (007 [.002, .012]) and plausible (.005 [.001, .008]). As shown in Table 19.1

and Table 19.2, in both veracity conditions, all cues apart from number of details and emotion significantly influenced participants' veracity judgements. Three of these cues mediated the relationship between EFT ability and veracity judgements in the truthful condition: unnecessary details (indirect effect = -.004 [-.007, -.001]), made sense (indirect effect = .003 [.001, .005]), and logical order (indirect effect = -.004 [.001, .007]). However, when these cues were added as multiple mediators in the final SEM (in consideration of the correlation between the cues), the indirect effect was non-significant (.0003 [-.001, .002]; Figure 4.1). In the deceptive condition, four cues partially mediated the relationship between EFT ability and veracity judgements: unnecessary details, made sense, logical order and plausible (indirect effect = -.0005 [-.005, -.001]; Figure 4.2).

Table 20.1

Means, Standard Deviations and Pearson Correlations of Participants Mean Ratings for each of the 8 cues in the truthful condition

Cue	*M*	*SD*	1	2	3	4	5	6	7
1.Detail	5.26	.97							
2.Contradictions	2.95	1.10	.20						
3.Emotion	3.54	1.39	.42**	.67**					
4.Unnecessary Details	3.18	1.18	.36**	.58**	.53**				
5.Repeated Details/Words	2.34	1.12	.09	.70**	.55**	.81**			
6.Made Sense	5.54	.86	.46**	.21	.19	.15	.00		
7.Logical Order	5.23	1.05	.48**	.29*	.44*	.27	.24	.73**	
8.Plausible	5.73	.81	.31*	.05	.06	-.01	-.09	.82**	.62**

**p <.05. **p <.01.*

Table 20.2

Means, Standard Deviations and Pearson Correlations of Participants Mean Ratings for each of the 8 cues in the deceptive condition

Cue	*M*	*SD*	1	2	3	4	5	6	7
1.Detail	5.25	.95							
2.Contradictions	2.85	1.27	.06						
3.Emotion	4.95	.97	.67**	.32*					
4.Unnecessary Details	3.28	1.12	.26	.62**	.44**				
5.Repeated Details/Words	2.59	1.15	.11	.70**	.26	.79**			
6.Made Sense	5.20	.85	.41**	.23	.49**	.44**	.34*		
7.Logical Order	4.55	1.16	.27	.40**	.26	.55**	.44**	.64**	
8.Plausible	5.58	.87	.57**	.06	.47**	.25	.18	.67**	.39**

**p <.05. **p <.01.*

Table 21.1

Study 2 Linear regression table for EFT ability predicting subjective cue use

		Coefficient	*SE*	*t*	*p*	*Adjusted p*	95% CI
M1 Details	Truthful	<.0001	<.0001	2.274	.026*	.103	.001, .010
	Deceptive	<.0001	<.0001	.62	.537	.537	-.004, .007
M2 Contradictions	Truthful	<.0001	<.0001	.801	.426	.426	-.004, .009
	Deceptive	.003	.002	1.435	.155	.458	-.001, .007
M3 Emotion	Truthful	.009	.003	3.12	.003**	.020*	.003, .015
	Deceptive	<.0001	<.0001	1.212	.229	.458	-.002, .009
M4 Unnecessary Details	Truthful	.010	.003	2.94	.004**	.026*	.003, .017
	Deceptive	<.0001	<.0001	3.617	.001***	.004**	.006, .019
M5 Repeated Words	Truthful	.005	.002	2.099	.039*	.117	<.001, .009
	Deceptive	.007	.003	2.587	.012*	.050*	.002, .012
M6 Made Sense	Truthful	.005	.002	3.019	.003**	.024*	.002, .009
	Deceptive	<.0001	<.0001	2.708	.008**	.050*	.002, .011
M7 Logical Order	Truthful	<.0001	<.0001	2.621	.011*	.052	.002, .014
	Deceptive	.007	.003	2.679	.009**	.050*	.002, .012
M8 Plausible	Truthful	<.0001	<.0001	1.083	.282	.426	-.002, .006
	Deceptive	.005	.002	2.556	.013*	.050*	.001, .008

*$p < .05$. **$p < .01$. ***$p < .001$.

Figure 4.1

*Unstandardised coefficients for the effect of EFT ability on veracity judgements mediated by the cues unnecessary details, logical order and made sense in the truthful condition. 1000 bootstrapped samples. *$p < .05$.*

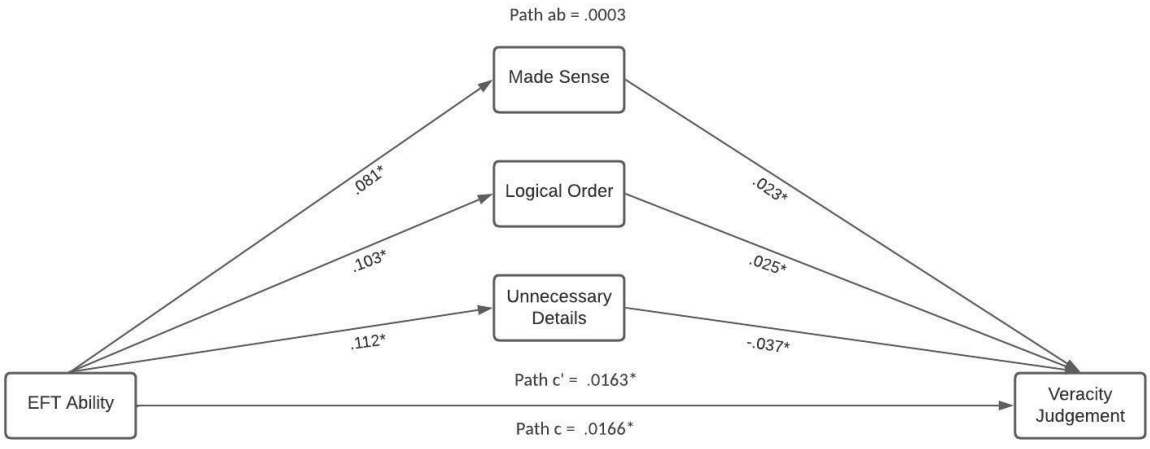
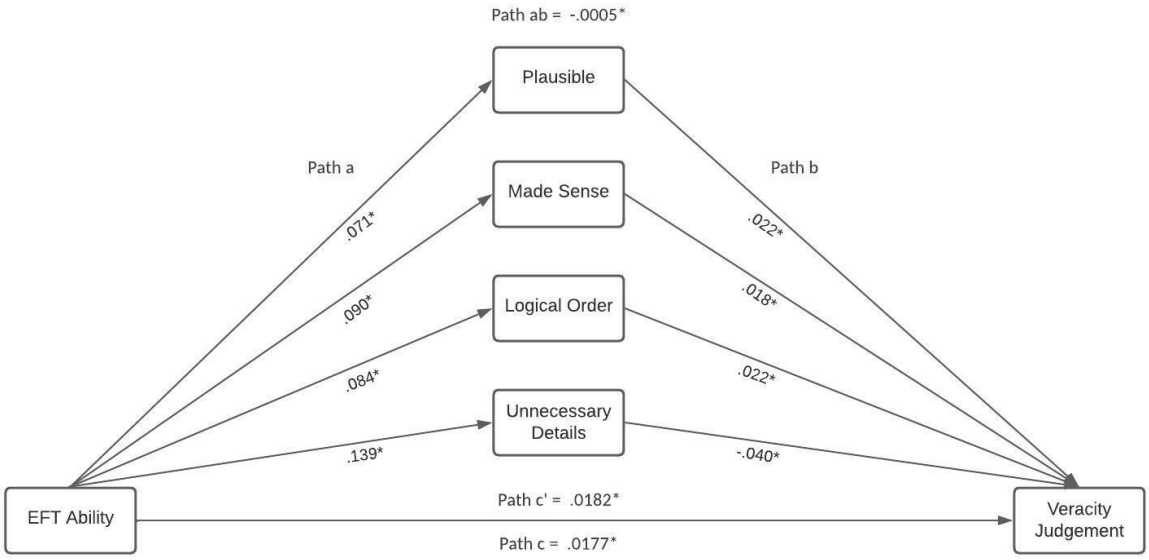


Figure 4.2

*Unstandardised coefficients for the effect of EFT ability on veracity judgements mediated by the cues unnecessary details, logical order, made sense and plausible in the deceptive condition. 1000 bootstrapped samples. *p <.05. **p <.01.*



Study 2: Discussion

Supporting Hypothesis 5, Study 2 showed that higher EFT individuals, when telling the truth and when lying, were more likely to be judged as truthful than lower EFT individuals. Partially supporting Hypothesis 6, the EFT ability of the sender affected subjective cue use in the truthful condition (emotion, unnecessary details, and made sense), and in the deceptive condition (unnecessary details, repeated words, made sense, logical order and plausible). Supporting Hypothesis 7, for both the truthful and the deceptive statements, all cues apart from number of details and emotion significantly influenced participants' veracity judgements. The results of the SEM analyses showed that in the truthful condition, the effect of EFT ability on veracity judgements was not mediated by subjective cue ratings. However, in the deceptive condition, the EFT ability and veracity judgement relationship was partially mediated by the cues unnecessary details, made sense, logical order and plausible. Therefore Hypothesis 8 was partially supported.

General discussion

Overall, the results from both studies demonstrated that the EFT ability of the sender affected the extent to which each cue influenced participants veracity judgements of verbal (Study 1) and written statements (Study 2). Furthermore, subjective cues influenced veracity judgements in truthful and deceptive verbal statements and written statements.

Study 1 failed to support Hypothesis 1 and prior findings of EFT ability predicting perceived veracity (O'Connell et al., under review). However, Study 2 demonstrated this effect (supporting Hypothesis 5 and replicating O'Connell et al. (under review). It is unclear why this effect was not found in Study 1. It could be due to Study 1 using a subset of audio clips (90) from O'Connell et al. (under review). The reduced size of the stimulus set may have led to a reduced power to detect an effect (Levine et al., 2022). It may also be due to the change in modality: veracity judgement accuracy is affected by stimuli presentation modality (Bond & DePaulo, 2006). The more information to process in the audio stimuli in Study 1 compared to the written statements used in Study 2 may have led to the deceptive cues being easier for participants to detect in the written stimuli (Bauchner et al., 1977; 1980). If detecting the cues is easier, the differences between high and low EFT participants may have become more apparent.

As predicted in Hypotheses 2 and 6, subjective cue use was affected by the EFT ability of the sender in both studies. These results suggest higher EFT individuals' verbal statements are perceived as containing more unnecessary details than statements from lower EFT individuals. Furthermore, higher EFT individuals' written statements appear to contain more unnecessary and repeated word/details, make more sense, follow more of a logical order, and are more than plausible than statements from lower EFT individuals. This is in line with O'Connell et al (under review) , who found higher EFT individuals providing longer and more detailed written and verbal statements.

As predicted in Hypothesis 3 and 7, the results from Study 1 and Study 2 support previous findings that different cues affect truthful and deceptive judgements (e.g., Bogaard et al., 2016; Hartwig & Bond, 2011; Hudson et al., 2020). In general, the subjective cue use reported by participants is consistent with the literature on objective cues (e.g., DePaulo et al, 2003; Johnson & Raye, 1981; Leal et al, 2015), with the exceptions of unnecessary details and spontaneous corrections in the deceptive condition in Study 2. Here, participants report to see the cue as indicating deception while in the literature these cues are considered as truthfulness indicators (Amado et al., 2016; Strömwall et al., 2004; Vrij et al., 2011). For the cues filler words and repeated words (Study 2), and the cue accent (Study 1) for truthful judgement, there is conflicting evidence in

the deception literature; see Lev-Ari and Keysar (2010); Villar and Castillo (2016); Vrij and Nahari (2017).

Partially supporting Hypothesis 4 and 8, in Study 1, three cues partially mediated the relationship between EFT ability and veracity judgements (unnecessary details, logical order and nervousness). In Study 2, there was no mediation effect of the cues in the truthful condition, but in the deceptive condition, four cues partially mediated the EFT ability and veracity judgement relationship (unnecessary details, made sense, logical order and plausible). These results strengthen the theory that people with high EFT are more credible, because they provide more information and providing more information is perceived as a cue to truthfulness (Hudson et al., 2020).

Limitations and future research

The current study employed self-reported cue use. It is possible that the cues that participants reported to have influenced their judgements may not be the actual cues they used (see Harwig & Bond, 2011). Extant findings in the literature demonstrate that self-reported cue use accurately corresponds to implicit cue use (Hamlin et al., 2018; Zuckerman et al., 1981), and can predict veracity judgements (Reinhard et al., 2011; Marksteiner et al., 2012), as it did in the current studies. However, cues predicting veracity judgements does not guarantee that they cause the veracity judgements.

Participants were presented with the cues checklist following each verbal and each written statement. It is possible that as participants became aware of the items in the checklist, they may have used these to guide their subsequent decisions which may have affected the results (see Levine et al., 2006). Whilst this may be a difficult challenge to overcome when requiring participants to rate multiple stimuli, one potential way to navigate this could be to ask participants to rate different cues following each statement. Alternatively, future research could consider examining practice effects in the analysis i.e., compare participants' ratings of their first cue to later/last cue ratings.

The negative wording of deceptive cues for example 'unnecessary details' or 'spontaneous corrections' may have influenced participants responses. The clear negative connotations of 'unnecessary' and 'corrections' may have suggested these as deceptive cues rather than truthful cues. Future research should consider alternative phrasing of cues, opting for more neutral wording such as 'elaborate details' and 'spontaneous changes'.

The current studies focussed on verbal and content cues via audio and written statements. Whilst there is evidence of consistency in credibility across different media (Bond et al., 2015), future research should consider other forms of media when asking participants to rate credibility.

Relatedly, future research may also examine whether higher (vs. lower) EFT individuals appear more credible in their non-verbal behaviour.

In Study 2, participants judged *either* truthful or deceptive accounts but were informed in the study instructions (in both veracity conditions) that the written statements would be truthful *and* deceptive, which may have affected the results. Whilst this approach was not how we intended to run the study and in essence forced participants to make some errors, if a mixed design was used, participants would have quickly recognised that the wedding invite statements were deceptive.

Conclusion

Our findings showed that the relationship between EFT ability and veracity judgements was partially mediated by various cues across verbal and written statements. This extends previous findings of higher EFT individuals being more credible than lower EFT individuals (O'Connell et al, under review), by suggesting that the cues present in higher EFT individual's accounts may be contributing to this credibility effect.

Supplementary Materials

Table 12.1

Wilcoxon signed-rank test showing differences between truthful and deceptive verbal and written statements

		Truthful Condition *M* (*SD*)	Deceptive Condition *M* (*SD*)	*Z*	*p*
Verbal statement	Details	37.02 (*26.14*)	28.99 (*15.07*)	-3.14	.002
	Words	75.08 (*51.52*)	55.69 (*27.58)*	-4.22	<.001
Written statement	Details	23.61 (*15.49*)	24.49 (*11.40)*	-.96	.335
	Words	62.54 (*39.32*)	66.88 (*32.65*)	-1.37	.169

Table 12.2

Experience of planning phase (N=93) and manipulation check (N=90)

	Truthful Condition *M* (*SD*)	Deceptive Condition *M* (*SD*)	*Z*	*p*
Sufficiency of 5- minute planning time 1(Not at all sufficient) – 7(Totally sufficient)	6.31 (*1.20)*	5.51 (*1.74*)	-4.03	<.001
Interest in planning 1(Not at all interesting) – 7(Very interesting)	4.08 (*1.70*)	4.73 (*1.48*)	-3.08	<.001
Satisfaction with planning 1(Not at all satisfied) – 7(Very satisfied)	6.00 (*1.23)*	4.87 (*1.66*)	-5.06	<.001
Difficulty of planning task 1(Very easy) – 7(Very difficult)	4.87 (*1.66*)	3.33 (*1.66*)	-4.66	<.005
Truthfulness in interview 1(Everything I told was true) – 7(Everything I told was a lie)	1.18 *(.51)*	5.22 (*1.53)*	-8.25	<.001

Table 13.1

Cues list in Study 1 and Study 2

Study 1 Cues	Study 2 Cues
Accent	Details
Pitch	Contradictions
Pauses	Emotion
Details	Unnecessary Details
Contradictions	Repeated Details/Words
Emotion	Made Sense
Unnecessary Details	Logical Order
Filler Words	Plausible
Repeated Details/Words	
Made Sense	
Logical Order	
Flowed Naturally	
Plausible	
Rehearsed	
Hesitant	
Nervous	
Think Hard	
Spontaneous Corrections	

Table 15.1

Study 1 SEM results with single mediator models

	Total Effect		Direct Effect		Indirect Effect	
	Est (*SE*)	95% CI	Est (*SE*)	95% CI	Est (*SE*)	95% CI
EFT Ability → Veracity	.006 (.005)	-.005, .018	.007 (.005)	-.004, .018	.000 (.000)	-.001, .000
Accent → Veracity	.012 (.005)*	.003, .022	.012 (.005)*	.003, .022		
EFT Ability → Veracity	.006 (.005)	-.003, .017	.006 (.005)	-.004, .017	.000 (.000)	.000, .000
Pitch → Veracity	-.003 (.004)	-.012, .005	-.003 (.004)	-.012, .005		
EFT Ability → Veracity	.007 (.005)	-.003, .017	.007 (.005)	-.003, .017	.000 (.001)	-.003, .002
Pauses → Veracity	-.034 (.005)*	-.045, -.024	-.034 (.005)*	-.045, -.024		
EFT Ability → Veracity	.006 (.005)	-.003, .017	.007 (.005)	-.003, .018	-.001 (.001)	-.002, .000
Details → Veracity	-.011 (.005)*	-.020, -.002	-.011 (.005)*	-.020, -.002		
EFT Ability → Veracity	.006 (.005)	-.004, .017	.007 (.005)	-.003, .017	-.001 (.001)	-.002, .001
Contradictions → Veracity	-.022 (.001)*	-.032, -.012	-.022 (.001)*	-.032, -.012		
EFT Ability → Veracity	.006 (.005)	-.003, .017	.006 (.005)	-.003, .017	.000 (.000)	-.001, .000
Emotion → Veracity	-.003 (.004)	-.013, .006	-.003 (.004)	-.013, .006		
EFT Ability → Veracity	.006 (*.005*)	-.003, .017	.010 (*.005*)	.000, .022	-.004 (*.001*)*	-.007, -.001
Unnecessary Details → Veracity	-.026 (*.005*)*	-.036, -.017	-.026 (*.005*)*	-.036, -.017		
EFT Ability → Veracity	.007 (.005)	-.002, .016	.008 (.005)	-.002, .018	-.001 (.002)	-.004, .002
Filler Words → Veracity	-.042 (.005)*	-.054, .032	-.042 (.005)*	-.054, .032		
EFT Ability → Veracity	.007 (.005)	-.003, .016	.007 (.005)	-.003, .018	.000 (.001)	-.003, .002
Repeated Words → Veracity	-.028 (.005)*	-.038, -.019	-.028 (.005)*	-.038, -.019		
EFT Ability → Veracity	.007 (.006)	-.005, .019	.003 (.006)	-.008, .015	.004 (.002)	.000 .007
Made Sense → Veracity	.044 (.006)*	.034, .056	.044 (.006)*	.034, .056		
EFT Ability → Veracity	.007 (*.006*)	-.006, .020	.001 (*.006*)	-.009, .013	.005 (*.002*)*	.002, .009
Logical Order → Veracity	.051 (*.006*)*	.042, .064	.051 (*.006*)*	.042, .064		
EFT Ability → Veracity	.006 (.006)	-.004, .018	.004 (.005)	-.006, .015	.002 (.001)	.000, .004
Flowed Naturally → Veracity	.025 (.005)*	.016, .035	.025 (.005)*	.016, .035		
EFT Ability → Veracity	.007 (.007)	-.006, .021	.007 (.006)	-.004, .019	.000 (.002)	-.005, .005
Plausible → Veracity	.061 (.006)*	.050, .076	.061 (.006)*	.050, .076		
EFT Ability → Veracity	.006 (.005)	-.003, .017	.005 (.006)	-.005, .016	.001 (.001)	-.001, .003
Rehearsed → Veracity	-.030 (.005)*	-.040, .021	-.030 (.005)*	-.040, .021		
EFT Ability → Veracity	.006 (.002)	-.001, .006	.004 (.005)	-.006, .015	.003 (.002)	-.001, .006
Hesitant → Veracity	-.044 (.006)*	-.056, -.034	-.044 (.006)*	-.056, -.034		

EFT Ability → Veracity	-.007 (*.005*)	-.003, .016	.003 (*.005*)	-.008, .013	.004 (*.002*)*	.001, .008
Nervous → Veracity	-.042 (*.005*)*	-.054, -.033	-.042 (*.005*)*	-.054, -.033		
EFT Ability → Veracity	.007 (.005)	-.003, .016	.006 (.005)	-.004, .017	.000 (.001)	-.002, .003
Think Hard → Veracity	-.034 (.005)*	-.045, -.025	-.034 (.005)*	-.045, -.025		
EFT Ability → Veracity	.006 (.005)	-.004, .017	.007 (.005)	-.003, .018	-.001 (.001)	-.002, .000
Spontaneous Corrections → Veracity	-.008 (.005)	-.018, .001	-.008 (.005)	-.018, .001		

**p <.05*

Table 16.1

Study 1 Ordinal regression results for EFT ability predicting cue use using the CLMM function

	Coefficient	*SE*	*Z*	*p*	*Adjusted p*	95% CI
M1 Accent	-.002	.002	-.656	.512	.980	-.006, .003
M2 Pitch	-.002	.002	-.656	.512	.980	-.006, .003
M3 Pauses	<-.001	.003	-.064	.949	.980	-.007, .003
M4 Details	.004	.003	1.234	.217	.980	-.002, .009
M5 Contradictions	.002	.002	.969	.332	.980	-.002, .005
M6 Emotion	.003	.002	1.671	.095	.980	-.001, .007
M7 Unnecessary Details	.009	.003	3.581	.0003***	.005**	.004, .014
M8 Filler Words	.001	.003	.251	.802	.980	-.005, .006
M9 Repeated Words	<.0001	<.0001	.025	.98	.980	-.005, .005
M10 Made Sense	.004	.002	2.118	.0342*	.479	<.001, .008
M11 Logical Order	.006	.002	3.268	.0011**	.019*	.003, .010
M12 Flowed Naturally	.004	.002	2.494	.0126*	.189	.001, .008
M13 Plausible	<-.0001	.002	-.186	.852	.980	-.004, .003
M14 Rehearsed	-.002	.003	-.802	.422	.980	-.008, .003
M15 Hesitant	-.004	.002	-.206	.0394*	.512	-.009, -.000
M16 Nervous	-.005	.002	-2.569	.0102*	.163	-.009, -.001
M17 Think Hard	<-.0001	.002	-.228	.82	.980	-.004, .003
M18 Spontaneous Corrections	.001	.003	.299	.765	.980	-.005, .007

**p <.05. **p <.01. ***p <.001.*

Table 18.1

Study 2 Ordinal regression results for EFT ability predicting cue use using the CLMM function

	Veracity Condition	Coefficient	*SE*	*z*	*p*	*Adjusted p*	95% CI
M1 Details	Truthful	.008	.004	1.821	.069	.206	-.001, .016
	Deceptive	.003	.004	.758	.449	.449	-.004, .010
M2 Contradictions	Truthful	-.001	.004	-.385	.701	.701	-.009, .006
	Deceptive	.005	.003	1.697	.0896	.358	-.001, .011
M3 Emotion	Truthful	.009	.004	2.399	.017*	.083	.002, .016
	Deceptive	.006	.004	1.502	.133	.399	-.002, .013
M4 Unnecessary Details	Truthful	.012	.004	3.241	.001**	.010*	.005, .020
	Deceptive	.011	.004	2.829	.00467**	.037*	.003, .019
M5 Repeated Words	Truthful	.010	.004	2.649	.008**	.005**	.003, .017
	Deceptive	.004	.004	.864	.388	.449	-.005, .012
M6 Made Sense	Truthful	.006	.003	2.288	.022*	.088	.001, .011
	Deceptive	.007	.003	2.478	.0132*	.079	.001, .013
M7 Logical Order	Truthful	.010	.004	2.659	.008**	.049*	.003, .017
	Deceptive	.008	.003	2.326	.02*	.100	.001, .014
M8 Plausible	Truthful	.005	.004	1.18	.238	.476	-.003, .013
	Deceptive	.006	.002	2.611	.00904**	.063	.002, .011

**p <.05. **p <.01. ***p <.001.*

Table 19.1

Study 2 Truthful Condition - SEM results with single mediator models

	Total Effect		Direct Effect		Indirect Effect	
	Est (*SE*)	95% CI	Est (*SE*)	95% CI	Est (*SE*)	95% CI
EFT Ability → Veracity	.014 (.007)*	.002, .027	.015 (.007)*	.002, .028	.000 (.000)	-.001, .000
Details → Veracity	-.005 (.005)	-.014, .005	-.005 (.005)	-.014, .005		
EFT Ability → Veracity	.017 (.006)*	.006, .029	.018 (.006)*	.007, .032	-.002 (.002)	-.005, .002
Contradictions → Veracity	-.053 (.005)*	-.064, -.043	-.053 (.005)*	-.064, -.043		
EFT Ability → Veracity	.014 (.007)*	.002, .027	.014 (.007)*	.002, .028	.000 (.000)	-.001, .001
Emotion → Veracity	-.003 (.005)	-.012, .007	-.003 (.005)	-.012, .007		
EFT Ability → Veracity	.015* (*.007*)	.003, .028	.019 (*.007)**	.006, .033	-.004 (*.001*)*	-.007, -.001
Unnecessary Details → Veracity	-.034 (*.005*)*	-.043, -.025	-.034 (*.005*)*	-.043, -.025		
EFT Ability → Veracity	.015 (*.006*)*	.003, .027	.016 (*.007*)*	.003, .029	-.002 (*.001*)	-.003, .000
Repeated Words → Veracity	-.023 (*.005*)*	-.033, -.014	-.023 (*.005*)*	-.033, -.014		
EFT Ability → Veracity	.015 (*.007*)*	.002, .030	.013 (*.007*)	.000, .026	.003 (*.001*)*	.001, .005

Made Sense → Veracity	.036 (*.005*)*	.027, .046	.036 (*.005*)*	.027, .046		
EFT Ability → Veracity	.015 (*.008*)	.000, .031	.011 (*.007*)	-.001, .025	.004 (*.001*)*	.001, .007
Logical Order → Veracity	.035 (*.005)**	.025, .045	.035 (*.005)**	.025, .045		
EFT Ability → Veracity	.018 (.009)	.000, .036	.015 (.008)*	.001, .030	.003 (.003)	-.002, .008
Plausible → Veracity	.083 (.008)*	.069, .099	.083 (.008)*	.069, .099		

*1000 bootstrapped samples. *p <.05.*

Table 19.2

Study 2 Deceptive Condition - SEM results with single mediator models

	Total Effect		Direct Effect		Indirect Effect	
	Est (*SE*)	95% CI	Est (*SE*)	95% CI	Est (*SE*)	95% CI
EFT Ability → Veracity	.015 (.007)*	.001, .028	.015 (.007)*	.001, .029	.000 (.000)	-.001, .000
Details → Veracity	-.006 (.004)	-.015, .001	-.006 (.004)	-.015, .001		
EFT Ability → Veracity	.016 (.007)*	.003, .030	.017 (.007)*	.004, .032	-.001 (.001)	-.004, .000
Contradictions → Veracity	-.035 (.005)*	-.045, -.027	-.035 (.005)*	-.045, -.027		
EFT Ability → Veracity	.014 (.007)*	.001, .028	.014 (.007)*	.002, .028	.000 (.001)	.000, .001
Emotion → Veracity	.004 (.004)	-.004, .011	.004 (.004)	-.004, .011		
EFT Ability → Veracity	.015* (*.007*)	.003, .028	.019 (*.007*)*	.006, .033	-.004 (*.001*)*	-.007, -.001
Unnecessary Details → Veracity	-.034 (*.005*)*	-.043, -.025	-.034 (*.005*)*	-.043, -.025		
EFT Ability → Veracity	.015 (*.006*)*	.003, .027	.016 (*.007*)*	.003, .029	-.002 (*.001*)	-.003, .000
Repeated Words → Veracity	-.023 (*.005*)*	-.033, -.014	-.023 (*.005*)*	-.033, -.014		
EFT Ability → Veracity	.016 (*.008*)	.000, .031	.012 (*.007*)	-.001, .026	.003 (*.001*)*	.001, .006
Made Sense → Veracity	.036 (*.005*)*	.027, .046	.036 (*.005*)*	.027, .046		
EFT Ability → Veracity	.016 (.008)*	.002, .031	.013 (.007)	.000, .026	.003 (.001)*	.001, .006
Logical Order → Veracity	.040 (.005)*	.031, .050	.040 (.005)*	.031, .050		
EFT Ability → Veracity	.016 (.007)*	.003, .031	.013 (.007)*	.001, .028	.003 (.001)*	.001, .005
Plausible → Veracity	.039 (.005)*	.031, .049	.039 (.005)*	.031, .049		

*1000 bootstrapped samples. *p <.05.*

Chapter 6: The effect of Episodic Future Thinking ability on credibility in occupation interviews

Abstract

In this paper we describe three studies that explored whether individual differences in Episodic Future Thought (EFT) ability affects credibility when participants told the truth and lied about their occupation. Credibility was measured by the number of perceptual details, statement length, level of detail and plausibility in verbal accounts and sketches (Study 1) and by other participants' veracity judgments of the verbal accounts (Study 2) and sketches (Study 3). In Study 1, participants with higher EFT ability generated more detailed verbal accounts and more plausible sketches than those with lower EFT ability. In Studies 2 and 3, EFT ability did not predict veracity judgements of the verbal accounts or sketches derived from Study 1. The findings across all studies suggest that EFT ability affects the ability to generate credible accounts however, EFT ability does not affect credibility judgements.

Introduction

Deception detection and the behavioural cues related to truth-telling and lying have been studied extensively, however, much less is known about the individual differences in successful truth-telling and lying ability. This is surprising given the practical benefits of identifying individuals for whom effective truth-telling and lying ability is required for job specific purposes (e.g., undercover police officers, politicians, military leaders, lawyers, professional gamblers; Semrad et al., 2019). Vrij and Granhag (2010) suggest various factors are involved to enable an individual to be a 'good' liar: personality, emotions, behaviour, response to cognitive load and decoding skills. Vrij and Granhag (2010) suggest that some individuals display suspicious behaviour whereas some people display behaviours related to honesty and likeability, independently of whether they are telling the truth or lying. This notion has been explored in sender demeanour studies where irrespective of the veracity of a statement, senders with a truthful and credible demeanour are judged as more believable (Burgoon et al., 2008; Levine et al., 2011). Vrij and Granhag (2010) suggest that good liars will not experience feelings of guilt and fear, which is related to their confidence and greater experience in lying behaviour. However, in high stakes situations when feelings of fear are experienced, good liars are better able to mask their emotions, thus making lie detection more difficult. Additionally, Vrij and Granhag (2010) argue that due to being more prepared and by providing less verifiable information, good liars will experience lying behaviour as less cognitively demanding. They suggest that good liars will be original, quick thinking, eloquent, have good memory and will monitor the behaviour of the receiver (and adjust their behaviour if they believe the receiver becomes suspicious). This suggests the possibility that individual differences in cognitive processing skills enables some people to be more successful liars than others.

Prior research has explored the cognitive processes involved in lying ability. Processes such as inhibitory control and working memory have been linked to successful lie-telling (Atkinson, 2019). Maldonado et al. (2018) found that when lying under high cognitive load, individuals with low working memory capacity had greater difficulty remembering the truth and were more easily detected as liars than individuals with higher working memory capacity. Briazu et al. (2017) found that individuals with greater counter factual thinking ability could generate more lies than individuals who think less counterfactually. These findings were related to lying about current or past events. Recently, O'Connell et al. (2022) explored how the cognitive process of Episodic Future Thought affects the ability to tell the truth and lie about future events. Through a series of studies, O'Connell et al (2022) found that individuals with higher EFT ability provided longer and more detailed truthful and deceptive verbal and written statements than individuals with lower EFT ability. When lying, high EFT individuals' verbal statements were judged as more credible than low

EFT individuals. High EFT individuals' truthful and deceptive written statements were also judged, by observers, as more credible than lower EFT individuals' statements.

Episodic Future Thought (EFT)

EFT is the ability to simulate personal future events in one or several mental visual images (Szpunar, 2010). There are individual differences in the ability to create mental depictions of simulated future events (D'Argembeau & Van der Linden, 2006), which is related to executive functioning (D'Argembeau et al, 2010; Hill & Emery, 2013). The functional benefits of EFT include decision making, goal processing, problem solving, coping, and implementation intentions (Schacter et al., 2017). EFT has also been linked to deception, i.e., when telling the truth, individuals report having formed a mental image more frequently, and describe their mental image in more detail than deceptive individuals (Granhag & Knieps, 2011; Knieps et al., 2013). Furthermore, individuals with higher EFT ability provide statements that contain more characteristics associated with credibility than lower EFT individuals (O'Connell et al., 2022). High EFT individuals, compared to low EFT individuals, are judged as more credible when lying verbally, and when both telling the truth and lying in written accounts (O'Connell et al., 2022). EFT ability also affects the truthful and deceptive cues individuals report as influencing their veracity judgements (O'Connell et al., in press).

Having the ability to simulate future events more vividly with more perceptual details should lead to individuals providing richer and more convincing accounts when telling the truth and lying about future events (O'Connell et al., 2022). However, what is not clear from the limited number of studies linking EFT to deception, is whether the cognitive process of EFT is only involved when the truthful and deceptive events are in the future (i.e., an intention). That is, does EFT affect the ability to tell the truth and lie about events that are in the past or present, or are higher EFT abilities only beneficial when lying about future events?

Decades of research in psychology and neuroscience have demonstrated the neural overlap between past and future thinking (i.e., episodic memory and episodic future thinking; Addis et al., 2007; Szpunar et al., 2007). More recently, Addis (2018) challenged the long-held notion of future thinking processes relying on episodic memory (EM), to a more iterative process whereby both EM and EFT are fundamentally part of the same continuum i.e., constructive episodic simulation. According to Addis (2018), whilst episodic memories and episodic future thoughts contain some differences e.g., temporal direction and details, these differences are superficial and the two processes rely on the same neural network and involve the same activation, integration and encoding processes. Therefore, in essence, EM and EFT are both products of the same episodic

constructive simulation process. If this is the case, EM and EFT ability should remain unaffected by temporal direction when performing certain cognitive tasks, such as lying. Therefore, we would expect that EFT also affects the ability to lie about past or current events.

Current Research

To test the relationship between EFT ability and credibility when discussing a current event, we conducted three studies. All studies in the current paper were pre-registered (https://osf.io/w37ky/?view_only=572786c5a8a94cddaa1a4021617126cd).

Study 1: Aims and Hypotheses

In Study 1, participants' EFT ability was measured, and participants took part in three occupation interviews based on Vrij et al.'s (2012) experimental design. Vrij et al. (2012) found that truthful verbal descriptions of workplace layouts included significantly more people than deceptive accounts. Additionally, truthful workplace sketches were more plausible, contained more details, people, and detail of people drawn than deceptive sketches.

Based on O'Connell et al.'s (2022) findings that EFT ability predicts credibility of spoken and written statements, in the current study we predicted that higher EFT individuals will provide more credible accounts across all veracity conditions and modalities than individuals with lower EFT ability (Hypothesis 1; as measured by total number of perceptual details and words used across all interviews and verbal workplace layout descriptions, and the level of detail and plausibility of verbal workplace layout descriptions and sketches). Based on Vrij et al.'s (2012) findings and previous literature demonstrating truthful statements as more detailed and plausible than deceptive statements (Amado et al., 2016; Vrij et al., 2021), we also predicted that participants truthful workplace layout descriptions and sketches will be more credible than workplace layout descriptions and sketches of their deceptive occupations (Hypothesis 2), as measured by the same dependent variables in Hypothesis 1.

Study 1: Method

Participants

We conducted an priori power analysis (using G*power): alpha was set at 0.05 and power was set at 0.9. The power analysis assumed two tailed, a H0 of 0, H1 variance explained of 0.2, three predictors (the EFT measure, veracity, and modality), level of detail as the DV, and a small effect size

of 0.2. This analysis suggested 75 participants would be needed. 75 participants (68 women, 7 men; M_{age} = 18.86 years, *SD*=1.01) were recruited via the University's research participation system and earned 2 course credits for participation.

Design

A 3(Veracity: Truthful vs. Chosen deceptive vs. Forced deceptive) x 2(Modality: Spoken vs. Sketch) x 6(Order of interviews: 1 vs. 2 vs. 3 vs. 4 vs. 5 vs. 6) mixed design was used. Veracity and modality were within-subjects factors and the order of interviews was a between-subjects factor. Participants were randomly assigned to one level of the between-subjects factor (see Table 21.1 for interview order in supplementary materials). The dependent variables were the total number of perceptual details and words participants used across all three interviews; the total number of perceptual details and words participants used in their verbal workplace layout descriptions; and the level of detail and plausibility of participants' verbal workplace layout descriptions and sketches. [3]

Materials

In accordance with the pre-registration (https://osf.io/w37ky/?view_only=572786c5a8a94cddaa1a4021617126cd), participants EFT ability was measured using an episodic details task (EDT; adapted from D'Argembeau et al., 2010) combined with a Memory Characteristics Questionnaire (MCQ; Johnson et al., 1988). The EDT required participants to imagine something they will do on their next holiday. Participants were then asked to verbally describe this event in as much detail as possible, including where they plan on going, who they will be with, what is around them, and any other details they could think of. Immediately after this task, participants were asked to complete 24 questions (adapted from the MCQ; Johnson et al., 1988), relating to the participants' subjective experience of the holiday event they had described. Participants rated their answers on a 7-point scale; for example, clarity of location (1=vague, 7=very clear); sounds/noises (1=none, 7=many); and visual details (1=little, 7=a lot). Participants also completed three additional questionnaires in relation to the occupation interviews. The first questionnaire was completed before the EDT task, and included demographic information (age and gender), the participants' occupation, and a list of 19 occupations in which

[3] In order to fully replicate Vrij et al.'s (2012) experimental design, we also collected data on the number of people and level of detail of people mentioned and sketched in the workplace layout descriptions/sketches, please see https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b for the data and results.

participants rated how much they knew about each of the occupations on a scale from 1(I know very little about this occupation) to 7(I know a lot about this occupation). The listed occupations were derived from a pilot study (see https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b for full pilot study). Participants also completed a pre-interview questionnaire indicating how motivated they were to perform well in the interviews on a 7-point scale from 1(not at all motivated) to 7(very motivated). Participants were then asked if they have done anything to prepare for the interviews (yes vs. no), for those that answered yes, we then asked them to describe what preparation they had done (open response). For those that responded no, we asked them to indicate why they had not done any preparation (open response). The post interview questionnaire listed all the interview questions and asked participants to rate on a 7-point scale how expected or unexpected they found each of the interview questions when asked them by the interviewer from 1(unexpected/surprised) to 7(expected).

Procedure

Ethical approval for the current study was obtained from the University's Faculty of Science and Technology Research Ethics Committee (FSTREC). The interview procedure was based on a similar experimental set up to Vrij et al. (2012). The current study was conducted in two stages, the first stage involved measuring participants EFT ability using the EDT task, and stage two included the occupation interviews carried out 6-8 days after stage one. Participants were randomly assigned to one of six groups, which determined the order of veracity conditions for the interviews (Table 22.1 in supplementary materials).

Stage one

Participants were video called via Microsoft Teams by the researcher who provided an overview of both stages of the study. The interviewer then sent the participant (via the chat function of Microsoft Teams) a Qualtrics link to the participant information sheet, the online consent form and the first study questionnaire. Once the participant completed the consent form and first questionnaire, they sent the interviewer a message via the chat function to indicate they had finished, and the interviewer video called them to carry out the EDT task. Participants were then asked to sketch a picture of their most dominant mental image that came to mind when they were describing their future holiday event in the EDT task. Participants then took a photograph of their drawing and uploaded it to a secure shared folder. The researcher then sent a link to the participant to complete the MCQ (via Qualtrics). Upon completion of the MCQ, the researcher emailed the participant to reiterate the study instructions and to provide the participant with an occupation they were to lie about in the subsequent occupation interview (forced lie condition). This occupation was

picked from the first questionnaire in which participants indicated they knew little about (a score of one or two). Where participants indicated they knew little about numerous occupations, the occupation was picked at random. No participants rated a high knowledge of all occupations. The remaining list of occupations was presented to participants with their true occupation removed (if applicable) and the forced lie occupation removed (resulting in 17/18 items). Participants were asked to reply to the researcher with their chosen lie occupation. The researcher then emailed these three occupations (truthful, forced lie, and chosen lie; in a counter balanced order) to the research assistant for interviewing the participant the following week. The research assistants were blind to the veracity of the occupations.

Stage two

Six to eight days after Stage 1, a research assistant called the participant via Microsoft Teams and sent them a link to the pre-interview questionnaire which was completed via Qualtrics. After participants completed the pre-interview questionnaire, the research assistant (blind to the veracity conditions) interviewed the participant using the same set of interview questions (see supporting information: interview questions) for their truthful occupation, their forced lie occupation, and their chosen lie occupation (consecutively; in a counter balanced order). During each interview, participants were also asked to sketch a layout of their workplace and label this with their participant number and the occupation they were sketching. The order in which the sketch question was asked was not manipulated following Vrij et al's. (2012) lack of an order effect for sketching vs. verbal responses. Following the interviews, participants took a photograph of their sketches and uploaded all three sketches to the researchers secure shared folder. The research assistant then sent the participant a link to the post interview questionnaire which was completed via Qualtrics. Participants were then debriefed. Interviews took between 20-60 minutes.

Coding

The episodic details task and interviews were transcribed verbatim. Two coders (blind to the veracity status of the participants) coded the episodic details task, participants' responses to all interview questions, and participants verbal descriptions of their workplace layout across all veracity conditions (truthful, forced lie, chosen lie) using the same perceptual details coding system in O'Connell et al. (2022). This coding system is similar to detail coding systems used in prior research (e.g., D'Argembeau et al., 2010; Warmelink et al; 2013; Warmelink & O'Connell, 2022). There were five detail coding categories: spatial, entity, sensory, thought/emotion/action, and temporal (see supporting information for category descriptions and examples). The workplace layout verbal descriptions and sketches were coded based on the Vrij et al.'s (2012) coding system: level of detail from (1) not detailed to (7) very detailed, and plausibility from (1) not plausible to (7) very plausible.

One coder rated 100% of the EDT, total interview responses, workplace layout descriptions and sketches, and another coder rated 25% of all tasks. As shown in Table 23.1 (supplementary materials), inter-rater reliability was between good and excellent across all perceptual categories for the EDT. As shown in Table 23.2 (supplementary materials), inter-rater reliability was excellent across all categories (except sensory, which was between moderate and good) for the total interview question responses. As shown in Table 23.3 (supplementary materials), inter-rater reliability was between moderate and excellent for level of detail and plausibility in the verbal descriptions of workplace layouts and sketches.

Data Analysis

EFT (Hypothesis 1)

To test whether the EFT ability of the sender predicted the number of perceptual details and words participants used in their verbal workplace layout description, and the number of perceptual details and words participants used in total across all interview questions, we fitted generalised linear mixed effects models using the glmer function from the lme4 package in R (Bates et al., 2015). The dependent variables were perceptual details and word count, we added fixed effects of Speaker Veracity and EFT ability, and random effects for participant and task order (in the workplace layout description model) and random effects for participant, task order, interview question number (in the total interview responses model). When building up the models, we used ANOVA to compare the Akaike Information Criteria (AIC) of each model after adding one fixed or random variable (see Tables 1 and 2). We ran Chi-square analyses to test whether each [more complex] model was a significantly better fit. The model with the lowest AIC value was chosen as the best fit to explain our data. Where two models did not differ significantly following the Chi-square test, the model with the least predictors was considered the best model.
All data and code have been made available at [Open Science Framework] and can be accessed at [https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b].

To test whether the EFT ability of the sender predicted the level of detail and plausibility of verbal workplace descriptions and sketches, we ran ordinal regressions using the CLMM function of the ordinal package (Christensen, 2019). The dependent variables were level of detail and level of plausibility, we added EFT ability as a fixed predictor and added in random effects for participant. Each model was run with the dependent variable from each veracity condition, for example, EFT ability → level of detail (truthful condition); EFT ability → plausibility (chosen lie condition) etc.

Veracity (Hypothesis 2)

To test the differences in the number of perceptual details and words in the total interview responses and the verbal workplace layout descriptions in the truthful, chosen lie, and forced lie conditions, we conducted a Friedman test and post hoc analysis using Wilcoxon signed-rank tests (with Bonferroni corrections). We used the same test to compare the level of detail and plausibility of participants verbal workplace descriptions and sketches across all veracity conditions. All statistical tests were 2-tailed.

Study 1: Results

Motivation, preparation and expectedness of interview questions

Participants reported being motivated to perform well in the interviews on a 7-point scale (*M*=5.42, *SD*=.97). The majority of participants (86.67%) rated 5 or above on the scale. 49 participants indicated that they had carried out preparation for the interviews by researching the role (N=37), speaking to someone in the occupation (N=3), forming a plan (N=7), or thinking about the role (N=2). 26 participants indicated that they had not done any preparation for the interviews due to already knowing enough about the occupations (N=14), not being told to prepare (N=5), not wanting to affect the results (N=5), or being too busy (N=2). Interview question expectedness was rated on a 7-point scale from 1(unexpected/surprised) to 7(expected; see Table 24.1 in supplementary materials for means and standard deviations for each interview question). Overall, participants rated the request to sketch a layout of their workplace as less expected (*M*=3.99, *SD*=1.65) than the request to verbally describe the layout of their workplace (*M*=4.18, *SD*=1.58). However, a Wilcoxon signed-rank test showed this difference was not significant (N=73, *Z*=-.66, *p*=.510).

Hypotheses Testing

EFT ability (Hypothesis 1)

Number of Perceptual Details and Words in Total Interview Responses and Workplace Layout Descriptions. The model comparisons for EFT ability predicting the number of perceptual details and word count for total responses across all interview questions (Table 25.1) and the number of perceptual details and word count for the workplace layout descriptions (Table 25.2) are shown below. As shown in Table 25.1, M5 best fit the data for perceptual details and word count for total responses across interview questions. As shown in Table 25.2, M4 best fit the data for perceptual details and M3 best fit the data for word count for workplace descriptions. Table 25.3 shows the results for each of these best fit logistic multilevel models.

Table 25.1

Model comparison via AIC, BIC, and Chi Square for details and word count for total responses across interview questions

Model	df	AIC	BIC	Chi Square	*p*
M1 Detail ~1|Participant		17409	17426		
M2 Detail ~1|Participant + 1|Question	1	16544	16566	863.47	<.001***
M3 Detail ~ Task Order + 1| Participant + 1|Question	5	16556	16605	2.30	.806
M4 Detail ~ EDT Score + Task Order + 1| Participant + 1|Question	1	16531	16564	17.87	<.001***
Anova (M2, M4)	2			17.32	.002***
M5 Detail ~ EDT Score + Veracity + Task Order + 1|Participant + 1|Question	2	16515	16559	19.34	<.001***
Anova (M2, M5)	4			36.66	<.001***
M6 Detail ~ (EDT Score*Veracity) + Task Order + 1| Participant + 1|Question	3	16515	16570	3.90	.142
M1 Word Count ~1|Participant		21190	21206		
M2 Word Count ~1|Participant + 1|Question	1	20364	20386	827.9	<.001***
M3 Word Count ~ Task Order + 1| Participant + 1|Question	1	20365	20392	0.92	.338
M4 Word Count ~ EDT Score + Task Order + 1| Participant + 1|Question	1	20350	20383	16.97	<.001***
Anova (M2, M4)	2			17.89	<.001***
M5 Word Count ~ EDT Score + Veracity + Task Order + 1| Participant + 1|Question	2	20337	20381	15.55	<.001***
M6 Word Count ~ (EDT Score*Veracity) + Task Order + 1| Participant + 1|Question	2	20337	20392	3.94	.139

**p <.05. **p <.01. ***p <.001.*

Table 25.2

Model comparison via AIC, BIC, and Chi Square for details and word count of workplace descriptions

Model	df	AIC	BIC	Chi Square	*p*
M1 Detail ~1|Participant		702.92	713.17		
M2 Detail ~1|Participant + Task Order	5	710.51	737.84	2.42	.790
M3 Detail ~ Task Order + EDT Score + 1| Participant	1	703.83	734.58	8.67	.003**
M4 Detail ~ Task Order + EDT Score + Veracity + 1| Participant	2	691.84	729.42	15.99	<.001***
M5 Detail ~ (EDT Score*Veracity) + Task Order + 1| Participant	2	694.68	739.09	1.16	.559

M1 Word Count ~1|Participant		2723.9	2734.2		
M2 Word Count ~1|Participant + Task Order	5	2727.6	2754.9	6.40	.269
M3 Word Count ~ Task Order + EDT Score + 1| Participant	1	2713.5	2744.3	16.01	<.001***
M4 Word Count ~ Task Order + EDT Score + Veracity + 1| Participant	2	2712.5	2750.1	5.04	.080
M5 Word Count ~ (EDT Score*Veracity) + Task Order + 1| Participant	2	2711.6	2756.0	4.90	.086

*p <.05. **p <.01. ***p <.001.

Table 25.3

Logistic multilevel model results for EFT ability predicting number of perceptual details and words in workplace descriptions and total interview responses

Predictor EFT ability	**Dependent Variables**	*Estimate*	*SE*	*t*	*p*	*95% CI*
Total Interview Responses	Detail	.22	.05	4.29	<.001***	.12, .32
	Word Count	.69	.16	4.31	<.001***	.38, 1.01
Workplace layout description	Detail	.01	.004	2.89	.004**	.004, .02
	Word Count	1.32	.33	4.02	<.001***	.70, 1.94

*p <.05. **p <.01. ***p <.001.

As shown in Table 25.3, EFT ability significantly predicted the number of perceptual details and words in both tasks, i.e., participants with higher EFT ability used more perceptual details and words across all interview questions and when describing the layouts of their workplaces than participants with lower EFT ability. We also tested whether the veracity of the sender affected the number of perceptual details and words used in participants' workplace layout descriptions and total interview responses, and whether sender veracity predicted the level of detail and plausibility of participants workplace layout descriptions and sketches. As these findings are not relevant to the current hypotheses, we will not discuss them here, however, see supplementary materials: Sender Veracity Results. There were no interaction effects for EFT ability and Veracity for number of perceptual details in total interview responses (p=.142): truthful:forced lie β=-.05, SE=.04, t=-1.34, truthful:chosen lie β=-.08, SE=.04, t=-1.93), nor for word count (p=.140): truthful:forced lie β=-.20, SE=.12, t=-1.70, truthful:chosen lie β=-.20, SE=.12, t=-1.73). There were also no interaction effects for EFT ability and Veracity for number of perceptual details in workplace layout descriptions (p=.567): truthful:forced lie β=-.004, SE=.004, t=-1.02, truthful:chosen lie β=-.003, SE=.004, t=-0.78),

nor for word count (p=.089): truthful:forced lie β=-.86, *SE*=.39, t=-2.20, truthful:chosen lie β =-.39, *SE*=.39, t=-1.00).

Level of detail and plausibility of verbal workplace layout descriptions and sketches. As shown in Table 24.1, EFT ability significantly predicted the level of detail in verbal descriptions (*Z=3.15, p*=.002), but not in participants' sketches (*Z*=-.23, p=.819). Furthermore, EFT ability predicted plausibility ratings in both participants' verbal descriptions (*Z*=3.55, p<.001) and sketches (*Z*=3.47, p<.001).

Table 24.1

Ordinal regressions for EFT ability predicting level of detail and plausibility of participants verbal workplace descriptions and sketches

Predictor EFT ability	**Dependent variables**	*Estimate*	*SE*	**Z**	*p*	*95% CI*
Verbal description	Detail	.03	.01	3.15	.002**	.01, .04
	Plausible	.03	.01	3.55	<.001***	.01, .04
Sketch	Detail	-.003	.01	-.23	.819	-.03, .02
	Plausible	.01	.003	3.47	.001***	.01, .02

**p <.05. **p <.01. ***p <.001*

Overall, the results showed that higher EFT individuals used more perceptual details and words across all interview questions and when describing the layouts of their workplaces than participants with lower EFT ability. Also, higher EFT individuals' workplace layout descriptions were rated as more detailed and plausible than lower EFT individuals. Finally, higher EFT individuals' sketches were rated as more plausible (but not more detailed) than lower EFT individuals. Therefore Hypothesis 1 was partially supported.

Veracity (Hypothesis 2)

Number of Perceptual Details and Words in Total Interview Responses and Workplace Layout Descriptions. Responses across all interview questions contained more perceptual details in the truthful condition (M=302.91, *SD*=163.92) versus the forced lie condition (M=256.43, *SD*=128.29), and the chosen lie condition (M=283.63, *SD*=123.96, χ^2 (2)=7.15, p=.028. Post hoc analysis with Wilcoxon signed-rank tests (with a Bonferroni correction; p<.017) showed a significant difference between perceptual details in the truthful condition and the forced lie condition (*Z*=-3.03, p=.002) as well as between perceptual details in the chosen lie condition and forced lie condition (*Z*=-2.56, p=.011). There were no differences in perceptual details between the truthful condition and the chosen lie condition (*Z*=-1.27, p=.204).

Truthful workplace descriptions contained more perceptual details (M=68.35, *SD*=43.69) than forced lie descriptions (M=59.60, *SD*=33.15) and chosen lie descriptions (M=64.76, *SD*=41.54) however, this difference was not significant, χ^2 (2)=2.30, *p*=.316.

Participants used more words across all their interview responses in the truthful condition (M=881.89, *SD*=505.94), compared to the forced lie condition (M=759.99, *SD*=383.42), and the chosen lie condition (M=842.69, *SD*=390.52; χ^2 (2)=6.51, *p*=.039). Post hoc analysis showed a significant difference in word count between the truthful condition and the forced lie condition (*Z*=-2.59, *p*=.010) as well as between the chosen lie condition and forced lie condition (*Z*=-2.76, *p*=.006). There was no difference in word count between the truthful condition and the chosen lie condition (*Z*=-.67, *p*=.501).

Truthful workplace descriptions contained more words (M=198.16, *SD*=130.39) than forced lie descriptions (M=174.61, *SD* = 94.55) and chosen lie descriptions (M=193.69, *SD*=121.02) however, this difference was not significant, χ^2 (2)=2.09, *p*=.351.

Level of detail and plausibility of verbal workplace layout descriptions and sketches. Truthful workplace descriptions (N=75) were rated as higher in detail (M=5.21, *SD*=1.27) than forced lie descriptions (M=4.67, *SD*=1.29) and chosen lie descriptions (M=4.84, *SD*=1.26), χ^2 (2)=12.39, *p*=.002. Post hoc analysis with Wilcoxon signed-rank tests (with a Bonferroni correction; *p*<.017) showed a significant difference between level of detail in the truthful condition and the forced lie condition (*Z*=-3.52, *p*<.001) as well as between the truthful and chosen lie condition (*Z*=2.83, *p*=.005). There was no difference in the level of detail between the chosen lie condition and the forced lie condition (*Z*=-1.07, *p*=.284).

Truthful sketches (N=73) were rated as higher in level of detail (M=4.79, *SD*=.88) than forced lie sketches (M=4.56, *SD*=.76) and chosen lie sketches (M=4.51, *SD*=.75), χ^2 (2)=9.66, *p*=.008. Post hoc analysis showed a significant difference between level of detail in the truthful condition and the forced lie condition (*Z*=-2.52, *p*=.012) as well as between the truthful and chosen lie condition (*Z*=-2.95, *p*=.003). There were no differences in detail level between the chosen lie condition and the forced lie condition (*Z*=-.69, *p*=.493).

Truthful workplace descriptions were rated as more plausible (M=5.44, *SD*=1.27) than forced lie descriptions (M=4.48, *SD*=1.30), and chosen lie descriptions (M=4.83, *SD*=1.41), this difference was significant χ^2 (2)=20.09, *p*=<.001. Post hoc analysis showed a significant difference between plausibility in the truthful condition and the forced lie condition (*Z*=-5.11, *p*<.001) as well as between the truthful and chosen lie condition (*Z*=-3.87, *p*<.001). There was no difference in plausibility between the chosen lie condition and the forced lie condition (*Z*=-2.09, *p*=.037).

Truthful sketches were rated as more plausible (M=4.79, *SD*=1.01) than forced lie sketches (M=4.58, *SD*=.82), and chosen lie sketches (M=4.49, *SD*=.88), this difference was significant χ^2 (2)=10.14, *p*=.006. Post hoc analysis showed a significant difference between plausibility in the truthful condition and the forced lie condition (*Z*=-2.44, *p*=.015) as well as between the truthful and chosen lie condition (*Z*=-2.77, *p*=.006). There was no significant difference in plausibility between the chosen lie condition and the forced lie condition (*Z*=-.73, *p*=.464). Both truthful descriptions and sketches were rated as more plausible compared to deceptive descriptions/sketches, therefore Hypothesis 2 was supported.

Study 1: Discussion

As predicted in Hypothesis 1 and supporting O'Connell et al.'s (2022) findings, higher EFT individuals included more perceptual details and used more words when describing their workplace layouts and across all interview responses, than lower EFT individuals. Higher EFT individuals' verbal workplace layout descriptions were rated as higher in detail than lower EFT individuals, however, this EFT effect was not found in detail level in the sketches. Both verbal descriptions and sketches provided by higher EFT individuals were rated as more plausible than those provided by lower EFT individuals. Overall, all of the credibility measures in Hypothesis 1 (except level of detail in sketches) showed that high EFT participants were more credible than lower EFT participants.

As predicted in Hypothesis 2, the results showed that participants included more perceptual details and used more words across the whole interview in the truthful versus deceptive conditions. However, there were no differences in the number of perceptual details and words used in participants' workplace descriptions across veracity conditions. Truthful workplace descriptions and sketches were rated as higher in level of detail and plausibility than deceptive descriptions/sketches. These findings support previous research demonstrating truthful accounts to be more detailed and plausible than deceptive accounts (Amado et al., 2016; Vrij et al., 2021). The results also support Vrij et al.'s (2012) findings in their sketching condition; however, Vrij et al. (2012) found no veracity effects in the verbal condition, whereas in the current study we found veracity effects for detail level and plausibility across modalities.

Study 2: Aims and Hypotheses

Study 2 used the verbal workplace descriptions provided by participants in Study 1 to explore whether higher EFT individuals were *judged* as more credible than lower EFT individuals. O'Connell et al. (2022) found that deceptive verbal statements given by higher EFT individuals were judged as more credible than those of lower EFT individuals. Furthermore, when lying and telling the truth in written statements, higher EFT individuals were judged as more credible than lower EFT

individuals. Based on these findings, we predicted that higher EFT individuals would be judged as more credible in their truthful and deceptive statements than lower EFT individuals (Hypothesis 3).

Study 2: Method

Participants

Sample size was not determined by a priori analysis but by the number of required observer ratings (see Levine et al., 2022). To ensure each verbal statement was judged at least 10 times, 214 participants (159 female, 48 male, 3 non-binary, 4 prefer not to say) were recruited, aged between 18 years old and 72 years old (M_{age}=30.25 years, *SD*=14.36). 114 participants were recruited via the University's research participation system and earned 2 course credits for participation. 100 participants were recruited via Prolific and received £6.50 for participation. None of the participants recruited for Study 2 had taken part as participants in Study 1 or the Pilot Study. Each verbal statement was judged between 11 and 18 times.

Design

The study used a within-subjects design where participants judged the veracity (truth vs. lie) of verbal statements derived from Study 1. Each participant rated 15 verbal statements (a mixture of truthful, forced lie, and chosen lie statements). The statements were randomly selected on the survey platform Qualtrics. The dependent variables were the veracity judgments: 'do you believe this individual was describing the layout of their true workplace?' Yes vs. No; and participants' ratings of the cues present in the account on various 7-point scales (e.g., the presence of perceptual details in the account (sensory/auditory/spatial/temporal) from 1(Not at all) to 7(Often); whether the interviewee seemed nervous: 1(Extremely relaxed/comfortable) to 7(Extremely tense/nervous)). As the cue ratings are not relevant to the main aims and hypotheses of this paper, these ratings will not be further discussed (see https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b for cues list analysis, and results of the cue judgements).

Materials

225 (75 truthful, 75 forced lie, 75 chosen lie) verbal workplace descriptions were derived from Study 1. Four statements were not used as they were inaudible, which resulted in 221 statements being used in the current study. Participants judged 15 pseudo-randomly selected statements. The survey was set up so that participants were forced to answer each question before progressing to the next statement, therefore all participants judged all 15 statements.

Procedure

Ethical approval was obtained from the University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants completed the online study via the survey platform Qualtrics. Participants first read a participant information sheet and then gave online consent by agreeing to each statement on a consent form. The survey program pseudo-randomly selected 15 (truthful, forced lie, chosen lie) written statements for each participant. Participants were informed that they would be presented with 15 audio clips of individuals describing the layout of their workplaces (see supporting information for full instructions). After each statement, participants rated whether they believed the individual was describing their true workplace. Following this, participants rated a list of cues, indicating the extent to which each cue was present in the account they had listened to (e.g., perceptual details, emotion, whether the account made sense, followed a logical order, and was plausible; see https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b for full cues list and results). Upon completion of all verbal statement ratings, participants read a debrief form explaining the nature of the study. Participation took approximately 40 minutes.

Data Analysis

EFT ability and Veracity

To test whether the EFT ability of the sender affected perceived veracity judgements we fitted generalised linear mixed effects models using the glmer function from the lme4 package in R (Bates et al., 2015). The dependent variable was binary (veracity judgement: 1=Deceptive, 2=Truthful). We added fixed effects of Speaker Veracity and EFT ability, and random effects for rater, statement, participant (whether recruited via the university participant pool or Prolific), and previous experience (whether participants have previously completed any lie detection studies). When building up the models, we used ANOVA to compare the Akaike Information Criteria (AIC) of each model after adding one fixed or random variable (see Table 28.1). We ran Chi-square analyses to test whether each [more complex] model was a significantly better fit. The model with the lowest AIC value was chosen as the best fit to explain our data. Where two models did not differ significantly following the Chi-square test, the model with the least predictors was considered the best model. All statistical tests were 2-tailed.

All data and code have been made available at [Open Science Framework] and can be accessed at [https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b]. Accuracy rates by sender are also available on the OSF project page.

Study 2: Results

The model comparisons for EFT ability predicting veracity judgements of workplace layout descriptions are shown in Table 28.1.

Table 28.1

Model comparison via AIC, BIC, and Chi Square for EFT ability predicting veracity judgements

Model	df	AIC	BIC	Chi Square	*p*
M1 Veracity Judgement ~1|Rater		4187.7	4199.8		
M2 Veracity Judgement ~1|Rater + 1|Statement		4006.6	4024.9	183.06	<.001***
M3 Veracity Judgement ~ 1|Rater + 1|Statement + 1|SonaProlific	1	4008.3	4032.6	0.38	.539
M4 Veracity Judgement ~ 1|Rater + 1|Statement + 1|SonaProlific + 1|PreviousLieDetection	1	4010.3	4040.6	0	>.999
M5 Veracity Judgement ~ EDT.Score + 1|Rater + 1|Statement + 1|SonaProlific + 1|PreviousLieDetection	1	4009.5	4045.9	2.78	.0953
M6 VeracityJudgement ~EDT Score + SpeakerVeracity + 1|Rater + 1|Statement + 1|SonaProlific + 1|PreviousLieDetection	3	4006.7	4055.3	6.77	.080
M7 VeracityJudgement ~EDT.Score*SpeakerVeracity + 1|Rater + 1|Statement+ 1|SonaProlific+ 1|PreviousLieDetection	2	4004.7	4047.2	0	>.999
M7 Reduced Veracity Judgement ~ Speaker Veracity + 1|Rater + 1|Statement	2	4004.0	4034.3	6.67	.036

**p <.05. **p <.01. ***p <.001*

Results from the glmer showed that EFT ability did not predict veracity judgements β=.004, *SE*=.002, *z*=1.68, *p*=.094, [-.001, .01], therefore Hypothesis 3 was not supported. The best model to explain the data (M7 Reduced in Table 24.1) showed that speaker veracity (with random effects for rater and statement) significantly predicted veracity judgements in the forced lie condition β=-.45, *SE*=.17, *z*=-2.61, *p*=.009, [-.80, -.11]. That is, participants in the forced lie condition were more likely to be judged as deceptive than participants in the truthful condition. There were no interaction effects for EFT ability and Veracity for veracity judgements (*p*=.996): truthful:forced lie β=<-.001, *SE*=.01, *z*=-.03, truthful:chosen lie β=<-.001, *SE*=.01, *z*=-0.09).

Study 2: Discussion

The results of Study 2 showed that EFT ability did not predict veracity judgements. Therefore, Hypothesis 3 was not supported. The null findings conflict with previous research showing that deceptive verbal statements given by higher EFT individuals are judged as more truthful than lower EFT individuals' statements (O'Connell et al., 2022).

Study 3: Aims and Hypotheses

Based on O'Connell et al.'s (2022) findings of individuals with higher EFT ability (cf. individuals with lower EFT ability) being judged as more truthful when lying verbally, and higher EFT individuals being rated as more credible when telling the truth and lying in written statements, the current study aimed to explore whether this EFT ability – credibility relationship extends to sketching modality. We predicted that higher EFT individuals' truthful and deceptive sketches would be rated as more credible than lower EFT individuals (as measured by veracity and plausibility judgements of sketches; Hypothesis 4).

Study 3: Method

Participants

To ensure each sketch was judged at least 10 times (see Levine et al., 2022), 212 participants (176 female, 34 male, 31 non-binary, 1 prefer not to say) were recruited, aged between 18 years old and 70 years old (M_{age}=24.71 years, *SD*=10.71). 161 participants were recruited via the University's research participation system and earned 1 course credit for participation. 51 participants were recruited via Prolific and received £4.50 for participation. Each sketch was judged between 22 and 27 times.

Design

The study used a within-subjects design where participants judged the veracity (truth vs. lie) of the workplace sketches derived from Study 1. Each participant rated 26 sketches (a mixture of truthful, forced lie, chosen lie). The statements were randomly selected on the survey platform Qualtrics. The dependent variables were the veracity judgment: 'do you think this individual sketched their actual workplace?' Yes vs. No; and participants' ratings of the plausibility of the sketch on a 7-point scale from 1(Not plausible at all) to 7(Significantly plausible).

Materials

224 (74 truthful, 74 forced lie, and 74 chosen lie) workplace sketches were derived from Study 1 (One of the 75 participants failed to upload their three sketches). Participants judged 26 pseudo-randomly selected sketches, and the survey was set up so that participants were forced to answer each question before progressing to the next sketch, therefore all participants judged all 26 sketches.

Procedure

Ethical approval was obtained from the University's Faculty of Science and Technology Research Ethics Committee (FST18038). Participants completed the online study via the survey platform Qualtrics. Participants first read a participant information sheet and then gave online consent by agreeing to each statement on a consent form. The survey program pseudo-randomly selected 26 (truthful, forced lie, chosen lie) workplace sketches for each participant. Participants were informed that they would be presented with 26 sketches of the layout of individuals' workplaces (see supporting information for full instructions). After each sketch, participants were informed which occupation the sender was referring to in their sketch, they were then asked to rate whether they believed the individual sketched their actual (true) workplace. Following this, participants indicated whether they thought the sketch was a plausible illustration of the sender's workplace. Upon completion of all sketch ratings, participants read a debrief form explaining the nature of the study. Participation took approximately 10 minutes.

Data analysis

EFT ability and perceived veracity (Hypothesis 4)

The same data analysis was conducted as in Study 2. We fitted generalised linear mixed effects models with the dependent variable veracity (1=Deceptive, 2=Truthful). We added fixed effects of Speaker Veracity and EFT ability, and random effects for rater, statement, and participant (whether recruited via the university participant pool or Prolific). We used ANOVA to compare the Akaike Information Criteria (AIC) of each model after adding one fixed or random variable (see Table 25.1). We ran Chi-square analyses to test whether each [more complex] model was a significantly better fit. The model with the lowest AIC value was chosen as the best fit to explain our data. All statistical tests were 2-tailed. Accuracy rates by sender can be found on the OSF project page [https://osf.io/jnqtx/?view_only=3515932e96424e439780ba655d775c3b].

*EFT and Plausibility (**Hypothesis** 4)*

To test whether the EFT ability of the sender affected plausibility ratings we ran an ordinal regression model using the CLMM function of the Ordinal package in R (Christensen, 2019). We added fixed effects for EFT ability and sender veracity, and random effects for rater and sketch, and the dependent variable plausibility rating.

Study 3: Results

EFT ability and perceived veracity

The model comparisons for EFT ability predicting veracity judgements of sketches are shown in Table 29.1.

Table 29.1

Model comparison via AIC, BIC, and Chi Square for EFT ability predicting veracity judgements of sketches

Model	*df*	*AIC*	*BIC*	$\chi 2$	*p*
M1 Veracity Judgement ~1|Rater		7311.6	7324.8		
M2 Veracity Judgement ~1|Rater + 1|Sketch	1	6711.4	6731.3	602.17	<.001***
M3 Veracity Judgement ~1|Rater + 1|Sketch + 1|SonaProlific	1	6713.4	6739.8	0.04	.833
M4 Veracity Judgement ~EDT Score + 1|Rater + 1|Sketch + 1| SonaProlific	1	6713.5	6746.5	1.93	.165
M5 Veracity Judgement ~EDT Score + Sender Veracity + 1|Rater + 1|Sketch + 1| SonaProlific	2	6717.3	6763.6	0.12	.942
M6 Veracity Judgement ~ (EDT Score* Sender Veracity) + 1|Rater + 1|Sketch + 1| SonaProlific	2	6720.8	6780.4	0.51	.774
M6reduced Veracity Judgement ~Sender Veracity + 1|Rater + 1|Sketch + 1|SonaProlific	4	6715.3	6748.4	2.49	.646

*p <.05. **p <.01. ***p <.001

Results from the generalised mixed linear regression showed that EFT ability of the sender did not predict veracity judgements of the sketches, β=.003, *SE*=.002, *z*=1.39, *p*=.163, [-.001, .01], therefore Hypothesis 4 was not supported. Sender veracity did not predict veracity judgements when comparing the truthful condition to the chosen lie condition, β=.06, *SE*=.185, *z*=.33, *p*=.746, [-.001, .01], or the forced lie condition, β=.01, *SE*=.19, *z*=.06, *p*=.952, [-.001, .01]. The best model to explain the data was M2 including the two random variables Rater and Sketch with no fixed effects. There were no interaction effects for EFT ability and Veracity for veracity judgements (*p*=.773): truthful:forced lie β=-.003, *SE*=.01, *z*=-.55, truthful:chosen lie β=-.004, *SE*=.01, *z*=-.67).

EFT and Plausibility

Results from the ordinal regression models showed that EFT ability of the sender did not predict the level of plausibility of the sketch β=.003, *SE*=.002, *z*=1.48, *p*=.138, [-.001, .01]. Therefore, Hypothesis 4 was not supported. Furthermore, sender veracity did not predict plausibility ratings of the sketch when comparing the truthful condition to the forced lie condition β=.029, *SE*=.17, *z*=.17, *p*=.866, [-.31, .37] or the chosen lie condition β=.144, *SE*=.17, *z*=.66, *p*=.508, [-.22, .45].

Study 3: Discussion

The results from Study 3 failed to support our prediction and previous findings of the EFT ability of the sender affecting veracity judgements (O'Connell et al., 2022). The findings also failed to show that higher EFT individuals' sketches would be rated as more plausible than lower EFT individuals' sketches; therefore Hypothesis 4 was not supported. The possible reasons for these null findings are outlined in the general discussion.

General discussion

EFT ability

As predicted in Hypothesis 1 and supporting previous findings (O'Connell et al., 2022), the results from Study 1 showed that higher EFT individuals *generated* more credible accounts than lower EFT individuals. Higher EFT individuals included more perceptual details and words in their workplace layout descriptions and across all interview question responses, than lower EFT individuals. Verbal workplace layout descriptions provided by higher EFT individuals were rated as more detailed and plausible than lower EFT individuals. Higher EFT individuals' sketches were also rated as more plausible than lower EFT individuals although EFT ability did not affect the level of detail in the sketches. Overall, the findings from Study 1 lend support to previous research demonstrating EFT ability as a cognitive process involved in the formation of credible truthful and deceptive statements (O'Connell et al., 2022).

Whilst the results from Study 1 demonstrated a positive link between EFT ability and the *generation* of credible accounts, Studies 2 and 3 failed to support our predictions and previous EFT and credibility *judgement* findings (O'Connell et al., 2022). EFT ability did not predict perceived veracity judgements of verbal descriptions of workplace layouts (Study 2) or workplace layout sketches (Study 3). These findings conflict with O'Connell et al., (2022) who found EFT ability predicted veracity judgements of deceptive verbal accounts and truthful and deceptive written statements. Addis (2018) argues that EM and EFT are part of the same episodic constructive

simulation process, which would suggest that performing tasks involving these processes would be unaffected by temporal direction. The findings from Study 1 and O'Connell et al. (2022) that EFT ability predicts behaviours associated with credibility (e.g., by providing detailed and plausible accounts) supports Addis' (2018) idea. However, unlike O'Connell et al's. (2022) findings, in Studies 2 and 3, higher EFT individuals were not judged as more credible than lower EFT individuals. It may therefore be the case that EFT is involved in the believability aspect of credibility only when the truth/lie being told is in the future. Future research could examine the relationship between EFT ability and telling the truth/lying about past events, this would provide further evidence of whether the association between EFT ability and credibility is future specific or whether EFT ability represents a general simulation ability as suggested by Addis (2018).

Veracity

As predicted and supporting previous research (Amado et al., 2016; Vrij et al., 2021), the findings from Study 1 demonstrated a veracity effect across modalities: truthful workplace descriptions and sketches were rated as higher in detail and more plausible than deceptive descriptions/sketches. These findings replicate Vrij et al.'s (2012) findings in the sketching condition, however, Vrij et al. did not find any differences between veracity conditions in the verbal condition. This could be due to sample size i.e., there were more than double the number of participants in the current study compared to Vrij et al.'s (2012) study. The findings in Study 1 also showed that participants included more perceptual details and used more words in their responses across all interview questions in the truthful versus deceptive conditions. This supports findings in the literature of deceptive statements containing fewer details (Amado et al., 2016; Vrij, 2008) and fewer words than truthful statements (Granhag & Knieps, 2011; Sooniste et al., 2013). However, no differences in the number of words and perceptual details emerged in participants' workplace descriptions across veracity conditions. This may be due to the within subject design used in the current study, participants may have experienced practice effects by completing the three interviews consecutively, thus the first workplace layout description may have acted as a model statement for the following two interviews. It may also be due to the prescriptive instructions asking participants to include specific details in their descriptions. Future research could encourage more variation in participants responses by asking broader questions, although this may lead to responses shorter in length, reducing the number of deceptive cues available (Vrij et al., 2007).

Limitations

The sample used for the creation of the truthful and deceptive statements were undergraduate psychology students. This limited the type of occupations used in the current study

and may not be reflective of the general population. Vrij et al. (2012) used a smaller sample but made up of individuals in established occupations (e.g., pilot, teacher/lecturer, engineer, social worker). More varied (and skilled) occupations may have led to different findings. Future research should take this into consideration.

We suggested that the EFT ability and credibility judgement relationship is only present in future oriented tasks/statements based on the null findings in Study 2 and Study 3 compared to the positive findings in previous research (O'Connell et al., 2022). However, it is possible that the content of the statements led to these different findings. In O'Connell et al., (2022) various truthful and deceptive tasks were used (e.g., a mock crime; weekend plans; responses to a mock wedding invitation), whereas the current study only involved truthful and deceptive occupations. Future research could explore this by providing similar tasks only varied in temporal direction.

Although participants reported being motivated to perform well in the interviews, like most laboratory-based deception research with student populations, the low-stakes of the experimental design may have affected the results. In high stake situations, higher EFT individuals may be more motivated to appear credible and thus be judged as more believable. Future research should address this where practically and ethically possible.

Conclusion

Across this series of studies, we demonstrated that individuals with higher EFT ability *generated* more credible verbal accounts than individuals with lower EFT. Higher EFT individuals' truthful and deceptive sketches were also more plausible than lower EFT individuals. However, unlike previous research (O'Connell et al., 2022), the EFT ability of the sender did not affect veracity *judgements* of verbal statements nor veracity and plausibility *judgements* of workplace layout sketches. We suggest that the link between EFT ability and credibility judgements may only be present when the event being described/sketched is a future specific event.

Chapter 6: Supplementary Materials

Table 22.1

Order of interviews based on veracity condition

Order 1	Order 2	Order 3	Order 4	Order 5	Order 6
Truthful	Forced Lie	Chosen Lie	Truthful	Forced Lie	Chosen Lie
Forced Lie	Truthful	Truthful	Chosen Lie	Chosen Lie	Forced Lie
Chosen Lie	Chosen Lie	Forced Lie	Forced Lie	Truthful	Truthful

Interview Questions

1. What does your job entail?
2. Can you describe what you do in a typical day, hour by hour?
3. Can you please sketch a layout of your workplace in as much detail as you can, including where your desk/workstation is, your colleagues and supervisors' desks/workstations as well as any communal areas such as tea-making/kitchen facilities and toilets. If any of these details are irrelevant (you're your boss works in another building) please explain that in your drawing.
4. There must be one single experience in your occupation that must stand out – what is that? What happened?
5. Do you enjoy your job?
6. Please describe your place of work in as much detail as you can. Where appropriate, discuss where your desk/workstation is, your colleagues and supervisors' desks/workstations as well as any communal facilities such as tea-making/kitchen facilities and toilets. If any of the above details are irrelevant (e.g. your boss works in another building) then please explain'.
7. What skills are vital to your job?
8. How many hours do you work?
9. Can you tell me about a recent interaction or event that you were involved in within the last week that occurred in your workplace? Just something that springs to mind, but doesn't have to be out of the ordinary, but please do describe it in detail.

Coding Categories for the EDT task and interview question responses

Category	Category description
Spatial	Any reference to the position of an entity, direction, or spatial measurements (e.g., 'next to', 'in front', 'south of').
Entity	Objects, people, animals (e.g., 'surf board', 'my partner', 'the dog').
Sensory	References to touch, taste, smell, sound, sight as well as weather and atmosphere references (e.g., 'the ground was *hot*', '*tasted* of coconut', '*smell* of the sea').
Thought/ emotion	Introspective thoughts, emotions intentions of the participant or others in the described scene (e.g., 'I felt happy', 'calming', 'excited').
Action	Actions of the participant or anyone else described in the scene (e.g., 'I am *surfing'*, I will *walk* to the library', 'I will *pick up* some snacks').
Temporal	Any temporal (i.e., time) context or measurement ('My flight leaves at *12pm*', 'I will stay for *one hour*', the journey takes *two hours*').

Table 23.1

ICC for EDT

Perceptual Category	ICC	95%CI
Spatial	.895	.720, .960
Entity	.932	.826, .974
Sensory	.811	.442, .931
Thought/Emotion	.970	.922, .988
Action	.949	.827, .982
Temporal	.996	.985, .998
Total Details	.974	.935, .990

Table 23.2

ICC for interview question responses across all interviews

Perceptual Category	***ICC***	***95%CI***
Interview 1		
Spatial	.993	.969, .999
Entity	.996	.980, .999
Sensory	.688	-.198, .934
Thought/Emotion	.984	.870, .997
Action	.999	.994, 1.00
Temporal	.998	.991, 1.00
Total Details	.996	.978, .999
Interview 2		
Spatial	.993	.968, .999
Entity	.998	.987, 1.00
Sensory	.798	.001, .960
Thought/Emotion	.992	.932, .999
Action	.999	.997, 1.00
Temporal	.993	.845, .999
Total Details	.998	.991, 1.00
Interview 3		
Spatial	.998	.989, 1.00
Entity	.999	.990, 1.00
Sensory	.777	-.029, .955
Thought/Emotion	.979	.676, .997

Action	.997	.985, .999
Temporal	.998	.991, 1.00
Total Details	.999	.996, 1.00

Table 23.3

ICC for Verbal descriptions and Sketches across all interviews

	ICC	**95%CI**
Interview 1		
Sketch		
Detail	.738	.476, .868
Plausible	.794	.578, .898
Verbal description		
Detail	.760	.285, .913
Plausible	.861	.635, .947
Interview 2		
Sketch		
Detail	.945	.854, .979
Plausible	.925	.801, .972
Verbal description		
Detail	.944	.852, .979
Plausible	.736	.330, .898
Interview 3		
Sketch		
Detail	.847	.570, .945
Plausible	.757	.269, .915
Verbal description		
Detail	.809	.346, .934
Plausible	.851	.618, .942

Table 24.1

Means and standard deviations of participants ratings of expectedness of interview questions on 7-point scale from 1 (unexpected/surprised) to 7 (expected).

Interview question	M(*SD*)
What does your job entail?	6.66 (*.77*)
Can you describe what you do in a typical day, hour by hour?	5.23 (*1.38*)
Can you please sketch a layout of your workplace in as much detail as you can, including where your desk/workstation is, your colleagues and supervisors' desks/workstations as well as any communal areas such as tea-making/kitchen facilities and toilets. If any of these details are irrelevant (you're your boss works in another building) please explain that in your drawing.	3.99 (*1.65*)
There must be one single experience in your occupation that must stand out – what is that? What happened?	3.59 (*1.79*)
Do you enjoy your job?	5.66 (*1.71*)
Please describe your place of work in as much detail as you can. Where appropriate, discuss where your desk/workstation is, your colleagues and supervisors' desks/workstations as well as any communal facilities such as tea-making/kitchen facilities and toilets. If any of the above details are irrelevant (e.g. your boss works in another building) then please explain'.	4.18 (*1.58*)
How many hours do you work?	5.37 (*1.77*)
Can you tell me about a recent interaction or event that you were involved in within the last week that occurred in your workplace? Just something that springs to mind, but doesn't have to be out of the ordinary, but please do describe it in detail.	3.05 (*1.66*)
What skills are vital to your job?	5.44 (*1.52*)

Sender Veracity Results Study 1

Level of detail and plausibility

The results of the multilevel model for sender veracity predicting level of detail and plausibility are shown in Table 26.1. Sender veracity significantly predicted level of detail in the forced lie condition for the workplace layout descriptions (*Z*=-3.67, *p*<.0001), and the sketches *(Z*=15.41, *p*<.0001), as well the chosen lie condition for descriptions *(Z*=-2.46, *p*=.014) and sketches *(Z*=17.98, p<.0001). Thus, in the forced and chosen lie conditions, the descriptions and sketches were rated as containing significantly less details than the truthful condition. Sender veracity also predicted plausibility ratings in the forced lie workplace layout descriptions *(*Z=5.95, p<.0001), and the forced lie sketches *(Z*=375.57, p<.0001), as well the chosen lie descriptions *(*Z=3.95, p<.0001) and chosen lie sketches (*Z*=367.17, p<.0001). Therefore, compared to the truthful condition, descriptions and sketches in the forced lie and chosen lie condition were rated as being less plausible.

Table 26.1

Ordinal regression results for speaker veracity predicting level of detail and plausibility of verbal descriptions and sketches

Predictor Speaker Veracity	**Dependent Variables**	Condition	*Estimate*	*SE*	**z**	*p*	*95% CI*
Verbal description	Detail	Forced	-1.20	.33	-3.67	<.0001***	[-1.83, -.56]
		Chosen	-.78	.32	-2.46	.014*	[-1.40, -.16]
	Plausible	Forced	-2.04	.34	5.95	<.0001***	[-2.71, -1.37]
		Chosen	-1.29	.33	3.95	<.0001***	[-1.92, -.65]
Sketch	Detail	Forced	-1.32	.09	15.41	<.0001***	[-1.49, -1.15]
		Chosen	-1.58	.09	17.98	<.0001***	[-1.75, -1.40]
	Plausible	Forced	-1.34	.004	375.57	<.0001***	[-1.34, -1.33]
		Chosen	-1.61	.004	367.17	<.0001***	[-1.62, -1.60]

Perceptual details and word count for workplace descriptions and total interview responses

The results of the multilevel model for sender veracity predicting the number of perceptual details and words in workplace descriptions and total interview responses are shown in Table 27.1. Speaker veracity did not predict the number of perceptual details (p=.058) or the number of words (*p*=.079) in participants workplace descriptions. Speaker veracity did however predict the number of perceptual details (*p*=<.0001) and the number of words (*p*<.0001) in participants statements in the forced lie condition and the chosen lie condition. That is, participants statements contained significantly less details and words in the forced lie and chosen lie condition in comparison to the truthful condition.

Table 27.1

Logistic multilevel model results for sender veracity predicting number of perceptual details and words in workplace descriptions and total interview responses

Predictor Speaker Veracity	***Dependent Variable***	*Condition*	*Estimate*	*SE*	***t***	*95% CI*
Verbal description	Perceptual Detail	Forced	-10.595	4.473	-2.369	[-19.397, -1.858]
		Chosen	-6.327	4.447	-1.423	[-15.058, 2.372]
	Word Count	Forced	-28.660	12.763	-2.246	[-53.789, -3.733]
		Chosen	-15.865	12.688	-1.250	[-40.782, 8.951]
Total interview responses	Perceptual Detail	Forced	-5.680	1.296	4.384	[-8.219, -3.140]
		Chosen	-2.329	1.295	1.798	[-4.867, .209]
	Word Count	Forced	-14.900	3.737	3.987	[-22.225, -7.576]
		Chosen	-4.717	3.736	1.263	[-12.038, 2.604]

Study 2 Participant Instructions

'You will shortly be presented with 15 audio clips.
In a previous experiment, participants were asked to tell the truth about or lie about their occupation. For instance, in the lying condition, if the participants real occupation was an office worker, they were asked to pretend they worked in a supermarket. Participants were then asked to describe the layout of their truthful or deceptive workplace.
You will listen to each audio clip and be asked to judge whether you believe the layout description is a representation of an actual workplace i.e., the individual was telling the truth about their occupation, or you believe the description is not a representation of an actual workplace i.e., the individual was lying about their occupation.
The survey program will random select all 15 audio clips therefore you may be presented with all truthful layout descriptions, all deceptive layout descriptions or a mixture of truthful and deceptive layout descriptions.'

Study 3 Participant Instructions

'You will shortly be presented with 26 hand-drawn sketches.

In a previous experiment, participants were asked to tell the truth about or lie about their occupation. For instance, in the lying condition, if the participants real occupation was an office worker, they were asked to pretend they worked in a supermarket. Participants were then asked to sketch a layout of their truthful or deceptive workplace.

You will view each sketch and be asked to judge whether you believe the drawing is a representation of an actual workplace i.e., the individual was telling the truth about their occupation, or you believe the drawing is not a representation of an actual workplace i.e., the individual was lying about their occupation.

*Please note that participants were asked to write their participant number and job title on each sketch to enable us to monitor data collection. You **do not** need to pay attention to this information. The survey program will random select all 26 sketches therefore you may be presented with **all** truthful sketches, **all** deceptive sketches or a **mixture** of truthful and deceptive sketches.'*

Chapter 7: Thesis Discussion

Summary of findings

The aim of this thesis was to explore whether EFT ability affects truth-telling and lying ability from an individual differences approach. The thesis proposed that individuals with higher EFT ability (i.e., those that visualised future events in more detail) would appear more credible when telling the truth and lying about future and current events than individuals with lower EFT ability. It also posited that EFT ability will affect the subjective cue use of people judging their veracity. In three studies, truth-telling and lying ability was examined across modalities (spoken, written, and sketched) and was measured in two ways. Firstly, based on the deception literature (e.g., Vrij et al., 2010; Sooniste et al., 2013; Warmelink et al., 2013), we measured the level of detail and plausibility in participants statements/sketches and the length of participants spoken and written statements. Secondly, separate groups of participants judged the credibility of spoken/written statements and sketches. The first measure of truth-telling and lying ability showed that higher EFT individuals were more credible when telling the truth and lying about current and future events. The second measure of truth-telling and lying ability showed varied results: higher EFT individuals were judged as more credible when verbally lying (but not when telling the truth) about future events (although this was not replicated in Chapter 5). Higher EFT individuals were also judged as more credible in truthful and deceptive written statements about a future event. However, EFT ability did not affect credibility judgements when verbally telling the truth and lying about a current event, nor when sketching a current event. EFT ability also affected subjective cue use i.e., different cues were reported to have influenced participants veracity judgements depending on the EFT ability of the sender. Overall, the three studies therefore demonstrated some support for the hypothesised relationship between EFT ability and truth-telling and lying ability. Below I discuss the findings and the contributions they make to the areas of individual differences in deception ability, truthful and deceptive intentions, and EFT. I also discuss methodological issues and directions for future research.

Implications and future research

In comparison to research on the detection of lies, there is much less literature on the ability or skill of the liar in successful lie telling behaviour (Visser & Haze, 2014). The findings in the current thesis suggest that EFT ability contributes to effective truth-telling and lying behaviour. The positive EFT and credibility judgement relationship found in the future (but not current) related tasks would suggest that EFT ability is a future specific ability, rather than a more general simulation ability. This conflicts with Addis' (2020) episodic simulation hypothesis i.e., that imaginings are not different

from episodic memories, rather they are part of the same process. If EFT and Episodic Memory are fundamentally the same process i.e., constructive episodic simulation, we would expect to see similar performance in truth telling and lying when the event being described is about the future or a current situation. In order to test this, future research could explore the EFT and credibility link when individuals are describing past events. This would provide further evidence of whether the EFT ability and credibility relationship is future specific or whether EFT ability represents a general simulation ability as suggested by Addis (2018). Overall, the demonstration in this thesis of individual differences in EFT ability affecting credibility judgements of future but not current lies should inform future research to consider the temporal direction of the truth and lie being told.

Future research could also assess the link between EFT ability and credibility when individuals are describing non-episodic topics (e.g., opinions/attitudes or semantic knowledge). Semantic memory is involved in future-oriented mental time travel (e.g., Abraham et al., 2008; Anderson, 2012; Klein et al., 2002). The semantic scaffolding hypothesis posits that semantic memory facilitates EFT by providing a scaffold to allow the retrieval of memories and future thoughts (Irish & Piguet., 2013). In their taxonomy of prospection, Szpunar et al. (2014) suggest that various forms of future thinking fall on an episodic-semantic continuum. The temporal distance of future thoughts is also affected by different mechanisms. La Corte and Piolino (2016) propose a Temporal Distance in Future Thinking model (TDIFT) whereby episodic representations are involved in near future projections whereas distant future projections involve personal semantic representations. In summary, based on the suggested importance of semantic involvement in future-oriented mental time travel, future research could explore the EFT and credibility link when participants are describing a semantic related future event. Furthermore, future studies could vary the temporal distance of truthful and deceptive future events and explore whether this affects credibility.

Another line of enquiry could explore how individuals imagine the scenarios they are devising for truthful and deceptive tasks. There may be differences in the methods employed to imagine future scenarios which may in turn affect how individuals communicate when lying. Future research could ask participants to verbally describe/narrate when they are forming their imaginings to further understand the processes involved. Furthermore, the studies in the current thesis used prescriptive instructions for the EFT tasks and the truthful and deceptive tasks. Truth-telling and lying behaviour may be different if participants are able to create their own truthful and deceptive accounts.

There is also a possibility that EFT ability affects the ability to understand the mental states of the person in which they are lying to. There is evidence to show that EFT, EM, Mental Space

Travel (MST), and Theory of Mind (ToM) have functional similarities and depend on a common core brain network (Hassabis & Maguire, 2009; Spreng & Grady, 2010). Recently, Adornetti et al. (2021) explored the link between EFT and ToM in children aged between eight and 10 years old. The authors found that ToM scores correlated with a non-verbal measure of EFT and ToM scores predicted EFT identification scores. Based on these findings i.e., ToM ability predicts the ability to self-project into the future, it is possible that ToM ability may affect the ability to lie about future events. Future research on EFT and truth-telling/lying behaviour could include a ToM measure to explore this effect.

It is unclear from the findings why an EFT ability and credibility judgement relationship was found when participants described future (Chapter 4) but not current events (Chapter 6). These results may not be exclusively due to the EFT ability of the sender. Other factors may have contributed to the null findings in Chapter 6 such as the ability of the judges, the content and/or difficulty of the tasks that were used as the stimuli. Using different judges across the studies may have led to the inconsistent EFT and credibility judgement findings. Future research could use the same observers to judge the veracity of participants statements of past, current and future oriented events. This would highlight any consistencies/inconsistencies in judges' responses based on the temporal direction of the event being described. The different tasks used to create the stimuli across the studies may have also led to the inconsistent EFT and credibility judgement findings. The mock crime paradigm used in Chapter 4 may have represented a more 'high stakes' scenario than the occupation interview set up in Chapter 6. This may have put more pressure on higher EFT individuals to appear more credible when lying and led to the positive EFT and credibility judgement findings in Chapter 4 but not in Chapter 6. Similarly, the cognitive load required to perform the tasks may have affected how credible participants appeared. Maldonado et al. (2018) found that high cognitive load impairs the lying ability of individuals with low working memory capacity, whereas individuals with high working memory capacity are unaffected by cognitive load. It may be that the different veracity conditions across the occupation interviews in Chapter 6 were of similar difficulty leading to similar presentations of credibility, making credibility judgements more difficult. Whereas the mock crime set up in Chapter 4 may have imposed a greater cognitive load which led to the lower EFT individuals appearing less credible when lying and the higher EFT individuals being unaffected, thus appearing more credible when lying. Future research could examine these stimuli content and cognitive load issues by providing statements describing similar tasks with similar levels of cognitive load across presentation modalities, temporal orientation and veracity conditions.

Stimuli presentation modality (e.g., verbal/written/sketch) should also be considered in future research. Bond et al. (2015) showed that credibility is consistent across modalities. In the current thesis, the generation of credible truthful and deceptive accounts was consistent across spoken, written and sketch modality, however, credibility judgements varied across modalities. Future research should therefore consider that credibility effects found in one modality (e.g., verbal), may not be replicated in another modality (e.g., written accounts or sketches). It is unclear why credibility judgements were inconsistent across modalities the current studies. We suggested in Chapter 4, given the consistency of EFT and credibility in the written conditions, that this may be due to the lack of distractions that may be present in written accounts (Bauchner et al., 1977; 1980). More information is acquired from text only communication versus audio and audio-visual communication (Benson & Gunter, 1987; Salomon & Leigh, 1984). In relation to deception detection accuracy across presentation modalities, there is evidence that detecting lies is least accurate in video only modality (Bond & DePaulo, 2006; Burgoon et al., 2008). The evidence for accuracy when judging written statements is mixed (Davis et al., 2006; Porter et al., 2002). As discussed in Chapter 5, there are several hypotheses suggested to explain the modality/veracity effect, these include the distraction hypothesis (Bauchner et al., 1977; Maier & Thurber, 1968); the information overload hypothesis (Bauchner et al., 1980; Miller et al., 1981); and the situational familiarity hypothesis (Stiff et al., 1989). Caso et al. (2018) explored the interaction between senders' communicative competence, veracity, stimuli medium and accuracy in veracity judgements. Statements were provided by good truth-tellers, bad truth-tellers, good liars and bad liars and presented to observers via audio, video, audio-video or transcript. The results (full saturated model) showed that all four variables interacted and influenced veracity accuracy. Furthermore, when judging the good liar, accuracy was greater when judging transcripts whereas when judging the bad liar, accuracy was greater when judging audio accounts. Veracity accuracy when judging the good truth-teller and the bad truth-teller was positively associated with audio-video presentation. This suggests that there are more factors at play when considering the effect of presentation modality on deception judgements which should be considered in future research.

The findings in Chapter 4 build on existing deception about intentions research by providing further evidence that truthful statements about intentions are longer in length (Sooniste et al., 2013), more detailed (Sooniste et al., 2015; Warmelink et al., 2013), and more plausible than deceptive statements (Vrij et al., 2011). The findings also extend prior evidence of the cognitive processes that are involved in telling lies about current or past events (Atkinson, 2019; Briazu et al., 2017; Johnson et al, 2005; Maldonado et al., 2018) to lies about future events. In Chapter 3 I

suggested that EFT ability may be inter-related or jointly involved with other cognitive processes that have been linked to lying ability e.g., working memory capacity (Maldonado et al., 2018) and/or counter factual thinking ability (Briazu et al., 2017). Individual differences in working memory capacity also predict the ability to construct specific future related events (Hill & Emery, 2013). It is therefore likely that in addition to EFT ability, other processes are involved in truth-telling and lying ability about intentions. Future research could explore this by asking participants to complete multiple cognitive processing tasks and assess the correlation between the tasks on performance in truthful and deceptive tasks.

Future research could also explore the relationship between EFT ability and certain characteristics proposed to be associated with 'good liars' e.g., personality, behaviour, emotions, response to cognitive load and decoding skills (Vrij & Granhag, 2010). This would provide further insight into the mechanisms that enable higher EFT individuals to generate more credible accounts and how they display a more credible demeanour across veracity and modality conditions. It is possible that the EFT ability of the sender affects non-verbal behaviour. Non-verbal behaviours (e.g., perceived competence, composure, vocal and facial pleasantness, gaze aversion and postural shifts) influence judgements of credibility (Burgoon et al., 1990; Vrij, 2000; Zuckerman & Driver, 1985). Future research could explore whether higher EFT individuals exhibit more non-verbal behaviours associated with credibility than lower EFT individuals.

The findings in Chapter 5 provided some insight into the cues present in accounts that led to higher EFT individuals appearing more credible. Higher EFT individuals' verbal statements were perceived as containing more unnecessary details than statements from lower EFT individuals. Furthermore, higher EFT individuals' written statements were perceived as containing more unnecessary and repeated word/details, as making more sense, following a more logical order, and were more plausible than statements from lower EFT individuals. In Chapter 6, higher EFT individuals workplace layout descriptions were rated as containing more overall details and auditory details and the speakers voice was rated as higher pitched than lower EFT individuals. Overall, the results across the studies relating to the cues present in high EFT individuals' accounts strengthen the proposition that high EFT individuals are more credible as they provide more information and providing more information is perceived as a cue to truthfulness (Hudson et al., 2020). The findings discussed thus far extend prior research of individual differences in credibility and the cognitive processes involved in truth-telling and lying behaviour by demonstrating that EFT ability affected the ability to generate credible accounts, credibility judgements, and subjective cue use. This highlights the importance of the consideration of the ability of the sender in deception research.

The results from Chapter 4 failed to replicate Granghag and Knieps (2011) findings that truth-tellers report activating a mental image to a greater extent than liars when forming intentions. As outlined in Chapter 4, this may have been due to the study design i.e., adopting a within-subject design versus Granhag and Knieps (2011) between-subject design. Participating in two interviews may have led to participants first description of their mental image acting as model statement for their second mental image description. Also, some participants found the question of whether they formed a mental image when planning their task and to describe their mental image particularly odd and asked for clarification on what this meant. The framing of the question in Swedish (Granhag & Knieps, 2011 study) may have been simpler or less out of the ordinary compared to the framing of the question in English. The results from Chapter 4 also failed to support Granhag and Knieps (2011) findings that truth-tellers use more words when describing their mental image than liars. Our results do replicate Knieps et al. (2013) who found no differences in the number of details or words used when describing truthful and deceptive mental images. It may be the case that veracity effects are more salient in participants responses to their intentions (Chapter 4) and the planning of their intentions (Sooniste et al., 2013) rather than responses to questions about their mental images formed. Overall, future research may consider focussing on the description of an intention or the planning of an intention rather than mental images that are formed during these tasks. If researchers wish to pursue the mental image line of enquiry, participants should be briefed about the question and the concept should be explained in more detail.

There is currently no single measure of EFT ability. In order to determine which EFT task was the most valid measure to use in subsequent studies throughout the thesis, Chapter 3 used five future thinking tasks measuring different aspects of EFT (episodic details, fluency, specificity, and phenomenology), and assessed their relationship with participants' performance on a truthful and deceptive task. Prior studies have failed to demonstrate strong correlations between multiple EFT measures, suggesting distinct areas of future thinking (e.g., Cha et al., 2022). However, the results in Chapter 3 suggested that the EDT, AFT, and AST were all measuring a similar construct of EFT, whereas the VVIQ may be related to a different component of EFT. These findings support Hallford et al. (2019) findings of differences between verbal future thinking tasks and visual imagery tasks, and the involvement of different executive processes with different aspects of future thinking (D'Argembeau et al, 2010). As such, future research should consider the divergence in verbal representations and mental imagery representations of future events.

The majority of the future thinking tasks used in the literature are derived from memory measures. In a recent systematic review of over 20 measurements of episodic foresight i.e., the simulation of future scenarios, Miloyan and McFarlane (2019) highlight how this may be

problematic. Memory studies enable the verifiability of details whereas future events have not occurred at the time of measurement. The authors also highlight the difficulty in determining whether novel future events (which are the basis of future thinking measures) are truly novel or involve the rehearsal of previous mental scenarios. Overall, Miloyan and McFarlane (2019) argue that none of the measures in their review were appropriately validated and therefore the authors caution against the use of these measures. Whilst the measures used in the current thesis were included in Miloyan and McFarlane's (2019) review, we decided to proceed with the use of the EDT based on the results of the correlation and PCA, as well as the predictiveness on participant's performance in Chapter 3, in addition to prior evidence demonstrating good reliability of the EDT (D'Argembeau, 2010). Overall, the results from the current thesis and existing literature on EFT measures suggest that future research should look towards developing a single, valid and reliable measure of EFT ability.

Limitations

Coding and analysis

The EDT and participants' verbal statements and written statements in Chapter 4 as well as participants' workplace descriptions and total interview responses in Chapter 6 were coded using the same perceptual details coding system (adapted from D'Argembeau, 2010). It was decided to use the same coding system for consistency when comparing performance across the tasks. Perceptual details are frequently used as a measure in future thinking tasks e.g., the autobiographical interview (Levine et al., 2002), the Memory Characteristics Questionnaire (Johnson et al., 1988), the Experiential Index (Hassabis et al., 2007), as well as a measure in truth-telling and lying behaviour (e.g., Warmelink et al., 2012; Warmelink et al., 2019; Warmelink & O'Connell, 2022). However, it is possible that the coding system was measuring some other skill besides EFT ability or truth-telling/lying ability (e.g., descriptive ability or engagement with the task). Future research could explore this by providing participants with measures relating to talkativeness e.g., the interpersonal and/or unprompted speech task (Wardle et al., 2011) and assessing their performance in relation to truthful and deceptive statements. Alternatively different coding classification systems could be used for measuring EFT and truthful and deceptive statements.

The studies that involved power analysis to inform the sample size included level of detail as the dependent variable. We also measured other dependent variables (e.g., statement length and plausibility) that were not included in the power analysis. It is therefore possible that these studies were underpowered. Future research should consider adding all dependent variables to the power analysis to ensure the correct power is calculated.

Study setting

Study 1a in Chapter 4 was conducted in the laboratory and therefore not necessarily reflective of a realistic environment or high stakes situation. Relatedly, in Study 1 of Chapter 6, participants completed their occupation interviews online. Whilst this may not be reflective of a face-to-face interview, at the time the study was conducted i.e., during the Covid 19 pandemic, researchers and many organisations in general had switched to virtual platforms to perform operationally. Students were attending lectures and meeting with their lecturers virtually. Therefore, whilst online interviews may have traditionally been seen to lack ecological validity, at the time of conducting Study 1 in Chapter 6, this was 'part of the norm'.

The low-stakes nature of the occupation interviews in Chapter 6 may have diluted the EFT and credibility findings. Whilst the majority of deception research adopts low-stakes deception protocols (for ethical and practical considerations), the EFT and credibility relationship may have been found in a high-stakes lie scenario. However, a number of studies have demonstrated links between cognitive processes and truth-telling/lying ability in laboratory based/online experimental paradigms (e.g., Maldonado et al., 2018; Briazu et al., 2017), suggesting that these effects can be found in the unrealistic set up of lab-based studies. Participants were informed in their study instructions that the interviewer was blind to the veracity of the interviews, and it was their job to convince the interviewer that all three of their occupations were their true occupation. On average participants reported being highly motivated to perform well in the interviews and 65.33% of participants reported that they had carried out preparation for the interviews by researching the role, speaking to someone in the occupation, making a plan, or thinking about the role. This suggests that individuals took their participation in the experiment seriously. Whilst the occupation interviews were not related to obtaining a job, it should be noted that lying in occupation interviews is particularly common (Ellis, West, Ryan & DeShon, 2002; Levashina & Campion, 2007; Weiss & Feldman, 2006). In fact, Levashina and Campion (2007) found that over 90% of undergraduate job seekers engaged in faking during employment interviews. Therefore, being asked to lie about questions relating to their occupation may not have been as unusual for participants as one would expect.

By adopting a within-subject design in Study 1a in Chapter 4, it is possible that participants being intercepted twice in the same experiment (truthful and deceptive conditions) may have affected how they planned their second task and responded to questions in the second interview. Indeed, participants reported the extent to which they believed they were carrying their tasks

before being intercepted on a 7-point scale from 1(to a very low extent) to 7(to a very high extent) as significantly lower after carrying out their second task (N=87, *M*=2.75, *SD*=1.77) than their first task (*M*=5.15, *SD*=1.70, *p*<.0001). As this thesis explored the EFT and truth-telling/lying ability relationship from an individual differences approach, this necessitated a within subject design to assess participants performance across veracity conditions. Future research could test the EFT ability and credibility relationship using a between subject design or provide participants with different truthful and deceptive tasks.

Conclusion

Over the past 50 years, deception research has focussed on the cues that lead to observable differences between truth-tellers and liars and techniques designed to enhance these differences to enable more successful lie detection (Vrij, 2008). In comparison, much less research has been conducted to explore the cognitive processes that enable individuals to be more successful liars. The current thesis aimed to explore whether individual differences in EFT ability affected truth-telling and lying ability. Three main findings were demonstrated in this thesis. Firstly, higher EFT individuals generated more credible verbal and written statements when describing future events and more credible verbal statements when describing a current event compared to lower EFT individuals. Higher EFT individuals also generated more plausible (but not more detailed) sketches than lower EFT individuals. Secondly, higher EFT individuals verbal and written accounts were judged as more credible than lower EFT individuals when the event being described was future oriented. However, EFT ability did not affect credibility judgements of statements and sketches about a current event. Lastly, EFT ability affected the cues participants report to have influenced their credibility judgements. The findings in this thesis extend prior research exploring the cognitive processes involved in lying behaviour to that of lying about intentions and provide further support for individual differences in credibility. Overall, this thesis demonstrates the importance of considering the truth-telling and lying ability of the sender in deception research.

Supplementary materials: Table 30.1 Accuracy rates across judgement studies and presentation mediums

Chapter	Stimuli Medium	Percentage accurate judgements (M, *SD*)	Accuracy Range	Correlation of accuracy judgements truthful & deceptive
4	Audio	Overall group: 50.29% (*.24*) Truthful: 56.10% (*20.31*) Deceptive: 41.43% (*25.19*)	 10% - 100% 0%-100%	 Pearson Correlation = -.356** *P*=.001
5	Audio	Overall group: 48.70% (*.22*) Truthful: 56.10% (*20.31*) Deceptive: 41.29% (*21.94*)	 10% - 90% 0%-87.50%	 Pearson Correlation = -.197 *P*=.194
	Written	Truthful: 66.37% (*19.75*) Deceptive: 45.27% (*23.56*)	6.25% - 100% 0% - 87.50%	
6	Audio	Overall group: 48.14% (*.24*) Truthful: 66.54% (*20.47*) Forced lie: 41.26% (*19.68*) Chosen lie: 36.48% (*21.27*)	 7.69% - 100% 7.14% - 82.35% 0% - 90.91%	Truthful – Forced lie Pearson Correlation = -.422** *P*<.001 Truthful – Chosen lie Pearson Correlation = -.539** *P*<.001 Forced Lie – Chosen lie Pearson Correlation = .436** *P*<.001
	Sketch	Overall group: 45.67% *(.24*) Truthful: 60.52% (*21.21*) Forced lie: 37.93% (*20.67*) Chosen lie: 38.56% (*23.10*)	 0% - 95.65% 4% - 91.31% 0% - 100%	Truthful – Forced lie Pearson Correlation = -.475** *P*<.001 Truthful – Chosen lie Pearson Correlation = -.606** *P*<.001 Forced Lie – Chosen lie Pearson Correlation = .427** *P*<.001

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