**The Effect of Individual Differences in Episodic Future Thought on Perceived Credibility**

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**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.  This analysis suggested 102 participants would be needed. 104 participants (75 women, 29 men; *Mage* = 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.

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**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 O’Connell et al., *in prep*).

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 supplementary materials for order of task presentation).

***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, though/emotion/action, and temporal (D’Argembeau et al., 2010; see 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; *Mage* = 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; *Mage* = 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 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 1 here*

***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 2).

*Table 2 here*

**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 3). Therefore, Hypotheses 1d, 1e and 1f were supported and Hypothesis 1g was partially supported.

*Table 3 here*

**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 4). Therefore, Hypothesis 2c was not supported[[1]](#footnote-2).

*Table 4 here*

**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 5). Therefore, Hypotheses 2d, 2e, 2f and 2g were not supported.

*Table 5 here*

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 (*Mage*=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](https://journals.sagepub.com/doi/full/10.1177/0146167218796795)). 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.

**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. This analysis suggested 68 participants would be needed. 80 participants (63 female, 15 male, 1 other, 1 prefer not to say; *Mage* = 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 6).

*Table 6 here*

**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.

**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.

**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.

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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; F[örster et al, 2004)](https://www.sciencedirect.com/science/article/pii/S1871187112000417" \l "bib0060). 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.

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**Declaration of Interest Statement**

The authors report there are no competing interests to declare.

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**Appendix A**

**Order of task presentation**

|  |  |  |
| --- | --- | --- |
| Order 1 | Order 2 | Order 3 |
| Episodic details task and MCQ  First intention planning task | VVIQ  First intention planning task | Cue response task  First intention planning task |
| Interview 1 and post interview questionnaire | Interview 1 and post interview questionnaire | Interview 1 and post interview questionnaire |
| 3 time periods task | Episodic details task and MCQ | VVIQ |
| Cue response task  Second intention planning task | Cue response task  Second intention planning task | 3 time periods task  Second intention planning task |
| Interview 2 and post interview questionnaire | Interview 2 and post interview questionnaire | Interview 2 and post interview questionnaire |
| VVIQ | 3 time periods task | Episodic details task and MCQ |

**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?

* My imagination of the event is:

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?

* My imagination of the event is:

Very easy Very difficult

1. 2 3 4 5 6 7

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

* My imagination of the event is:

Not at all sufficient Totally sufficient

1. 2 3 4 5 6 7

How satisfied were you with the planning?

* My imagination of the event is:

Not at all satisfied Very satisfied

1. 2 3 4 5 6 7

How interesting did you find the planning?

* My imagination of the event is:

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)?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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?

* My imagination of the event is:

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

* My imagination of the event is:

Not at all difficult Very difficult

1 2 3 4 5 6 7

**Appendix E**

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

|  |  |
| --- | --- |
| Category | Category description |
| Spatial  Entity | Any reference to the position of an entity, direction, or spatial measurements (e.g., ‘next to’, ‘in front’, ‘south of’).  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**

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

|  |  |  |  |
| --- | --- | --- | --- |
| Task  EDT Task    Truthful Statement |  | Perceptual Category ICC95% CI | |
| Spatial  Entity  Sensory  Thought/Emotion/Action  Temporal | | .967  .854, .985  .971 .929, .989  .951 .877, .980  .966 .832, .984  .838 .407, .923 |
| Spatial  Entity  Sensory  Thought/Emotion/Action  Temporal | | .906 .758, .961  .972 .931, .989  .000 -1.374, .594  .954 .556, .976  .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

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

**Appendix H**

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

**Table 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  Deceptive | |  | .28 .09 3.19 .002  .17 .05 3.45 <.001 |
| Intentions Words Truthful | |  | .63 .17 3.75 <.001 |
| Deceptive | |  | .34 .09 3.79 <.001 |

**Table 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  Deceptive | |  | .35  .07 5.28 < .001  .27 .06 4.26 < .001 |
| Mental Image Words Truthful | |  | .79 .16 4.97 < .001 |
| Deceptive | |  | .63 .13 4.73 < .001 |

**Table 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  Deceptive | |  | .79  .16 .47, 1.10 <.001  .63 .13 .36, .89 <.001 |
| Pre-experiencing future event Truthful | |  | .27 .09 -.08, .46 .005 |
| Deceptive  Perceptual details mental image Truthful  Deceptive | |  | .17 .05 .07, .28 .002  .61 .18 .25, .97 .001  .34 .09 .15, .53 .001 |

Difficulty answering mental image Truthful -.00 .01 -.01, .01 .859

question

Deceptive .27 .01 .14, .40 < .001

**Table 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 Deceptive  Condition Condition  *M* (*SD*) *M* (*SD*) *Z p* *d* | |
| Intentions Description Details  Words | |  | 37.02 (*26.14*)  28.99 (*15.07*) -3.14 .002 0.33  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 |

**Table 5**

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

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Truthful Deceptive  Condition Condition  *M* (*SD*) *M* (*SD*) *Z p* *d* | |
| Formation of mental image  Pre-experiencing future event | |  | 5.40 (*1.26*)  5.34 (*1.33*) -.67 .502 0.15  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 |

**Table 6**

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

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

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). [↑](#footnote-ref-2)