

## ARTICLE

# The effect of episodic future thinking ability on subjective cue use when judging credibility

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## Abstract

**Background:** Episodic Future Thought (EFT) ability affects how credible individuals appear (O'Connell et al., *The effect of individual differences in episodic future thought on the ability to lie about intentions* [manuscript submitted for publication], Psychology Department, Lancaster University, 2022). 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

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individual's accounts may be contributing to this credibility effect.

#### KEYWORDS

cues, deception, episodic future thought, future thinking, lying

## 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 nonverbal (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, for example, 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 Jr. & 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 Jr. & DePaulo, 2008; O'Connell et al., 2022; Vrij et al., 2010). Whether people can appear credible consistently across situations is under debate. Bond Jr. 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 Jr. & 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 while 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., 2013a, 2013b). 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, 2013b). These findings suggest that truth-tellers may be engaging in EFT more than liars. It is possible that individuals with higher EFT ability, that is, those who utilize 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, that is, those with lower EFT ability. O'Connell et al. (2022) 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 Jr. & 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 utilize 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 anonymized 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., 2022; see [https://osf.io/bpkf3/?view\\_only=6a3e26159699465dbccdd09b66d-1cf3f](https://osf.io/bpkf3/?view_only=6a3e26159699465dbccdd09b66d-1cf3f)). 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=9f1a05cf39ce40aa9d-ca8c48859669c6](https://osf.io/987wp/?view_only=9f1a05cf39ce40aa9d-ca8c48859669c6)). Study 2 was not pre-registered as the original data (written statements) were collected at a later timepoint and for a different purpose, that is, 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'Connell et al.'s (2022) 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,  $H_0$  of 0, and one predictor (the EFT measure). 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%) versus medium (median 15%) versus 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 dependent variables were the veracity judgement: '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., 2022), 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 while 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 5 min 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

TABLE 1 Wilcoxon signed-rank test showing differences between truthful and deceptive verbal and written statements.

	Truthful condition	Deceptive condition		
	<i>M (SD)</i>	<i>M (SD)</i>	<i>Z</i>	<i>p</i>
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)	-0.96	.335
Words	62.54 (39.32)	66.88 (32.65)	-1.37	.169

TABLE 2 Experience of planning phase ( $N = 93$ ) and manipulation check ( $N = 90$ ).

	Truthful condition	Deceptive condition		
	<i>M (SD)</i>	<i>M (SD)</i>	<i>Z</i>	<i>p</i>
Sufficiency of 5-min 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

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 1 and Table 2). 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=9a0ba94d-4b4242e9b69f618fad7b92e8](https://osf.io/5dfsq/?view_only=9a0ba94d-4b4242e9b69f618fad7b92e8) 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 S3 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 3). We initially ran single mediator SEMs (i.e. EFT Ability → Cue → Veracity Judgement; Table S5). Due to participants' cue ratings significantly correlating (Table 3), 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 generalized 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 Jr, 2013; see Table S6 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](https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8)). We included random effects of Participant (Rater) and Statement (Audio) in each model.

All data and code have been made available at [Open Science Framework] and can be accessed at [[https://osf.io/5dfsq/?view\\_only=9a0ba94d4b4242e9b69f618fad7b92e8](https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8)]. These analyses differ substantially from the analyses preregistered at ([https://osf.io/987wp/?view\\_only=9f1a05cf39ce40aa9d-ca8c48859669c6](https://osf.io/987wp/?view_only=9f1a05cf39ce40aa9d-ca8c48859669c6)). The analyses presented here are a more suitable way to address the hypotheses.<sup>1</sup>

## STUDY 1: RESULTS

Table 3 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 S5 and the results for the multiple mediator SEM are shown in Figure 1. As shown in Figure 1, EFT ability did not predict the likelihood that the statement was rated as true (.001 [-.011, .012]). Table 4 shows that after adjusting  $p$  values for multiple comparisons, EFT ability predicted subjective cue ratings of one cue: unnecessary details (<.0001 [.004, .013]). Table S5 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, .056]), 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]), hesitation (-.044 [-.056, -.034]) and think hard (-.034 [-.045, -.025]). These results show that different cues influence participants' truthful (vs. deceptive) judgements. The results of

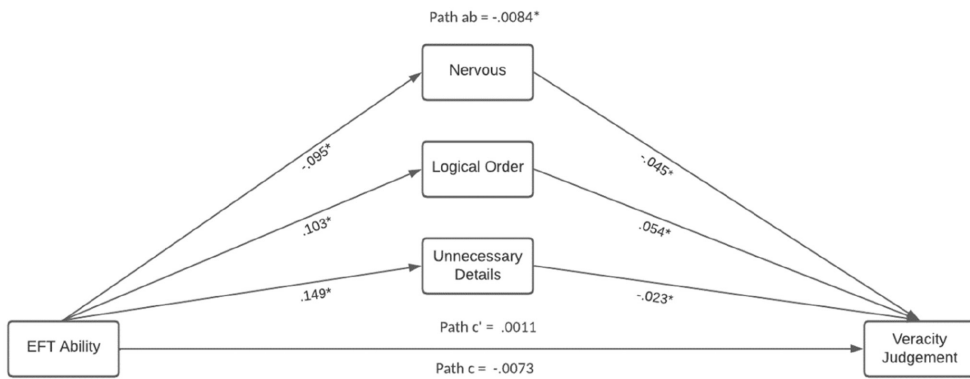
<sup>1</sup>We thank reviewer 2, who suggested these analyses and the R package used.



TABLE 3 Means, standard deviations, and Pearson correlations of participants mean ratings for each of the 18 cues in Study 1.

Cue	<i>M</i>	<i>SD</i>	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	0.95	.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	0.84	.15	.20	.34**	.55**	.48**	.22	.40**	.37**	.45**								
11. Logical Order	4.94	0.89	.09	.19	.29*	.58**	.37**	.21	.35**	.28*	.41**	.87**							
12. Flowed Naturally	5.22	0.82	.09	.21	.40**	.51**	.21	.34*	.31**	.34**	.32**	.31*	.62**						
13. Plausible	4.96	0.94	.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. Hesitant	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**

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



**FIGURE 1** Unstandardized coefficients for the effect of EFT ability on veracity judgements mediated by the cues unnecessary details, logical order, and nervousness. 1000 bootstrapped samples.  $*p < .05$ .

**TABLE 4** Study 1 Linear regression table for EFT ability predicting subjective cue use.

	Coefficient	SE	<i>t</i>	<i>p</i>	Adjusted <i>p</i>	95% CI
M1 Accent	-.001	.001	-0.741	.46	.946	-0.003, 0.002
M2 Pitch	-.001	.001	-0.723	.472	.946	-0.004, 0.002
M3 Pauses	<.0001	<.0001	0.154	.878	.946	-0.004, 0.004
M4 Details	<.0001	<.0001	20.448	.017*	.248	0.001, 0.007
M5 Contradictions	.002	.001	10.227	.205	.946	-0.001, 0.005
M6 Emotion	.003	.002	10.704	.092	.946	<-0.001, 0.006
M7 Unnecessary Details	<.0001	<.0001	30.555	.001***	.011*	0.004, 0.013
M8 Filler Words	<.0001	<.0001	0.699	.486	.946	-0.003, 0.005
M9 Repeated Words	<.0001	<.0001	0.371	.712	.946	-0.003, 0.005
M10 Made Sense	<.0001	<.0001	10.886	.063	.816	<-0.001, 0.006
M11 Logical Order	<.0001	<.0001	20.492	.0147*	.235	0.001, 0.007
M12 Flowed Naturally	<.0001	<.0001	20.076	.041*	.574	<0.001, 0.006
M13 Plausible	<.0001	<.0001	0.068	.946	.946	-0.003, 0.004
M14 Rehearsed	-.002	.002	-10.366	.185	.946	-0.006, 0.001
M15 Hesitant	-.004	.002	-10.726	.088	.946	-0.008, 0.001
M16 Nervous	-.005	.002	-20.883	.00501**	.085	-0.009, -0.002
M17 Think Hard	<-.001	.002	-0.177	.86	.946	-0.004, 0.003
M18 Spontaneous Corrections	<.0001	<.0001	10.444	.152	.946	-0.001, 0.007

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

the SEM also showed that three cues mediated the relationship between EFT ability and veracity judgements: unnecessary details, logical order and nervousness (indirect effect =  $-.008 [-0.009, -.003]$ ).

## 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. (2022; 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 judgement (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. (2022). 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, hesitation, 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

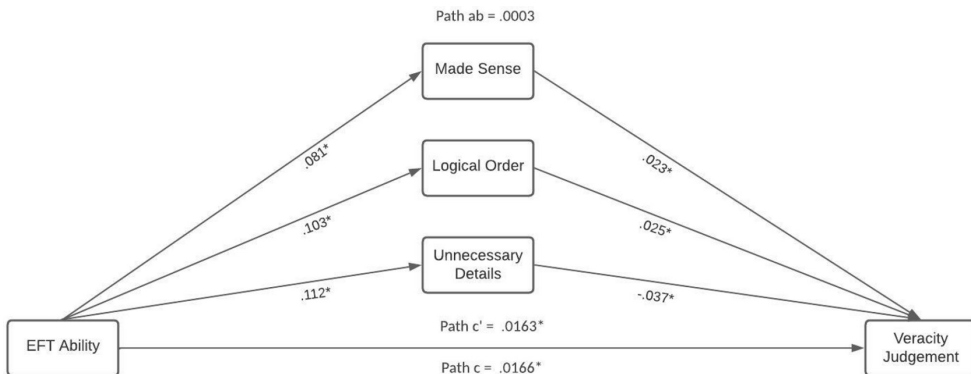
Ethical approval was obtained from the University's Faculty of Science and Technology Research Ethics Committee (FSTREC). The survey was completed via the online survey platform Qualtrics. Participants read a participant information sheet and then gave online consent by clicking each statement on a consent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

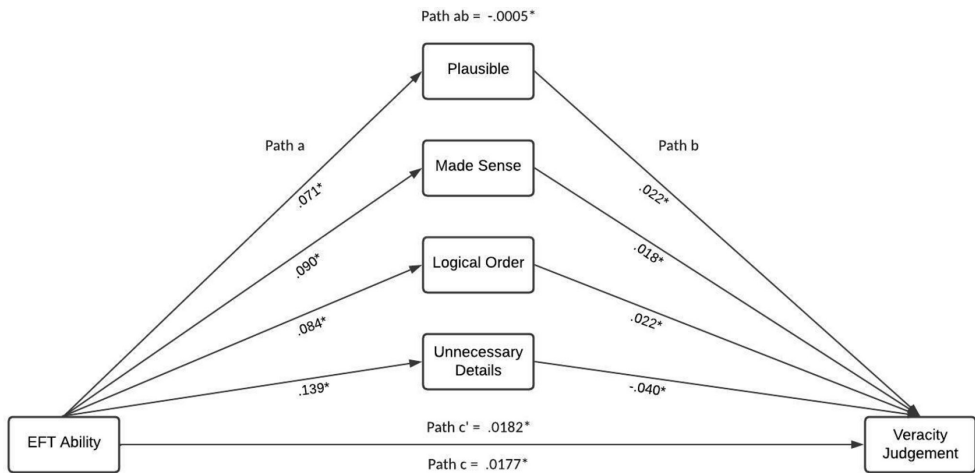
The same SEM analyses process were carried out as in Study 1. As in Study 1, the cue ratings were treated as continuous data, see Table S8 for results of ordinal regressions using the CLMM function (see [https://osf.io/5dfsq/?view\\_only=9a0ba94d4b4242e9b69f618fad7b92e8](https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8) for  $R^2$  regression results for LMER and CLMM models). Results from the single mediator SEMs are shown in Table S9 (truthful condition) and Table S10 (deceptive condition). 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 2 and Figure 3).

## STUDY 2: RESULTS

Tables 5 and 6 (Page 12) 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 2 (truthful condition) and Figure 3 (deceptive condition). As shown in these figures, EFT ability significantly



**FIGURE 2** Unstandardized 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 3** Unstandardized 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. \* $p < .05$ ; \*\* $p < .01$ .

predicted veracity judgements in the truthful condition (.016 [.003, .031]), and the deceptive condition (.018 [.004, .034]). Table 7 (Page 13) 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 Tables S9 and S10, 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 2). 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 3).

## 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.

**TABLE 5** Means, standard deviations, and Pearson correlations of participants' mean ratings for each of the 8 cues in the truthful condition.

Cue	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1.Detail	5.26	0.97							
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	0.86	.46**	.21	.19	.15	.00		
7.Logical Order	5.23	1.05	.48**	.29*	.44*	.27	.24	.73**	
8.Plausible	5.73	0.81	.31*	.05	.06	-.01	-.09	.82**	.62**

\* $p < .05$ ; \*\* $p < .01$ .

**TABLE 6** Means, standard deviations, and Pearson correlations of participants' mean ratings for each of the 8 cues in the deceptive condition.

Cue	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1.Detail	5.25	0.95							
2.Contradictions	2.85	1.27	.06						
3.Emotion	4.95	0.97	.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	0.85	.41**	.23	.49**	.44**	.34*		
7.Logical Order	4.55	1.16	.27	.40**	.26	.55**	.44**	.64**	
8.Plausible	5.58	0.87	.57**	.06	.47**	.25	.18	.67**	.39**

\* $p < .05$ ; \*\* $p < .01$ .

## 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., 2022). However, Study 2 demonstrated this effect (supporting Hypothesis 5 and replicating O'Connell et al. (2022)). 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. (2022). 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 Jr. & 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.

TABLE 7 Study 2 Linear regression table for EFT ability predicting subjective cue use.

	Coefficient	SE	<i>t</i>	<i>p</i>	Adjusted <i>p</i>	95% CI
M1 Details						
Truthful	<.0001	<.0001	2.274	.026*	.103	0.001, 0.010
Deceptive	<.0001	<.0001	0.62	.537	.537	-0.004, 0.007
M2 Contradictions						
Truthful	<.0001	<.0001	0.801	.426	.426	-0.004, 0.009
Deceptive	.003	.002	1.435	.155	.458	-0.001, 0.007
M3 Emotion						
Truthful	.009	.003	3.12	.003**	.020*	0.003, 0.015
Deceptive	<.0001	<.0001	1.212	.229	.458	-0.002, 0.009
M4 Unnecessary Details						
Truthful	.010	.003	2.94	.004**	.026**	0.003, 0.017
Deceptive	<.0001	<.0001	3.617	.001***	.004**	0.006, 0.019
M5 Repeated Words						
Truthful	.005	.002	2.099	.039*	.117	<0.001, 0.009
Deceptive	.007	.003	2.587	.012	.050*	0.002, 0.012
M6 Made Sense						
Truthful	.005	.002	3.019	.003**	.024*	0.002, 0.009
Deceptive	<.0001	<.0001	2.708	.008**	.050*	0.002, 0.011
M7 Logical Order						
Truthful	<.0001	<.0001	2.621	.011*	.052	0.002, 0.014
Deceptive	.007	.003	2.679	.009**	.050*	0.002, 0.012
M8 Plausible						
Truthful	<.0001	<.0001	1.083	.282	.426	-0.002, 0.006
Deceptive	.005	.002	2.556	.013*	.050*	0.001, 0.008

\**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

This is in line with O'Connell et al. (2022), 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 Hartwig & 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 (Marksteiner et al., 2012; Reinhard et al., 2011), 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). While 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, that is, 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. While there is evidence of consistency in credibility across different media (Bond Jr. 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. While 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 recognized 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. 2022), by suggesting that the cues present in higher EFT individual's accounts may be contributing to this credibility effect.

## AUTHOR CONTRIBUTIONS

**Zarah Vernham:** Conceptualization; supervision; writing – review and editing. **Paul Taylor:** Conceptualization; supervision. **Lara Warmelink:** Conceptualization; supervision; writing – review and editing.

## CONFLICT OF INTEREST STATEMENT

All authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in [Open Science Framework] at [https://osf.io/5dfsq/?view\\_only=9a0ba94d4b4242e9b69f618fad7b92e8](https://osf.io/5dfsq/?view_only=9a0ba94d4b4242e9b69f618fad7b92e8).



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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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