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The interaction of truthful and deceptive information

Brianna L. Verigin ^{a,b}, Ewout H. Meijer ^a, Aldert Vrij ^b and Leonie Zauzig^a

^aForensic Psychology Section, Faculty of Psychology and Neuroscience, Maastricht University, Maastricht, Netherlands; ^bDepartment of Psychology, University of Portsmouth, Portsmouth, United Kingdom

ABSTRACT

Research consistently shows that truthful accounts are richer in detail than deceptive accounts. It is unknown, however, how interviewees strategically regulate the information they provide when their accounts contain both truthful and deceptive information. This study examined how truths and lies interact, and whether interviewees' self-reported strategies reflect such interactions. Participants ($n=144$) provided one statement consisting of two elements. We manipulated the veracity of these elements, with participants allocated to either both truthful, both deceptive, or one truthful and the other deceptive conditions. Results indicated that interviewees calibrate the richness of detail provided in the first element of their statement based on the veracity of the following element. Moreover, our exploratory tests revealed that lies become more detailed when they are flanked by truthful information relative to when they are flanked by other deceptive information. The finding that truthful and deceptive information interacts to influence detail richness provides insight into liars' strategic manipulation of information when statements contain a mixture of truths and lies. Strategic manipulations of this kind could potentially threaten the reliability of commonly used verbal lie detection tools. This study also offers insight to legal practitioners who rely on baseline deviations to assess credibility.



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In the legal arena, ascertaining the credibility of an interviewee remains an integral component of the investigative process. However, credibility assessment is a challenging task. Decades of research indicate that humans are poor lie detectors, rarely achieving accuracy rates above chance level (Bond & DePaulo, 2006). One of the explanations for the poor lie detection performance is an overreliance on behavioural cues. No single behaviour, nor group of behaviours, is systematically and reliably indicative of deception (DePaulo et al., 2003; Hartwig & Bond, 2011; Wright & Wheatcroft, 2017), yet people continue to base their judgements on non-diagnostic behavioural cues such as gaze aversion or fidgeting (Bogaard, Meijer, Vrij, & Merckelbach, 2016; Strömwall, Granhag, & Hartwig, 2004).

CONTACT Brianna L. Verigin  brianna.verigin@maastrichtuniversity.nl  Faculty of Psychology and Neuroscience, Maastricht University, Universiteitssingel 40, Maastricht 6229 ER, Netherlands

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Research regarding verbal deception detection is more promising. A stable finding within the literature is that liars' statements contain significantly fewer details than truth-tellers' statements (Amado, Arce, Fariña, & Vilarino, 2016; DePaulo et al., 2003; Vrij, 2008a). More specifically, liars' statements contain less perceptual, spatial, and temporal details than truth-tellers' statements (Vrij, 2008a, 2008b). Much of these findings stem from research on Criteria-Based Content Analysis (CBCA; Steller & Köhnken, 1989) and Reality Monitoring (RM; Alonso-Quecuty, 1992, 1995; Johnson, Bush, & Mitchell, 1998; Johnson & Raye, 1981). Both CBCA and RM assume that recollections of personally experienced events are more detailed and coherent than statements about unexperienced or fabricated events (Johnson & Raye, 1981; Undeutsch, 1967, 1989; Vrij, 2005, 2008a) because memories of external origin (i.e. truthful reports) are based on perceptual processes whereas memories of internal origin (i.e. deceptive reports) are based on individuals' imagination and reasoning. In particular, it can be reasoned that truths represent experienced memories and are more likely to include perceptual, contextual and affective information and to be more clear and plausible than lies, which are based on imagination (Johnson & Raye, 1981).

Statements often consist of a mixture of both truths and lies. When given the opportunity, liars will incorporate their deception into descriptions of previous experiences, so called embedded lies. Evidence for the prevalence of embedded lies comes from Leins, Fisher, and Ross (2013). In two studies, these authors found that the majority of liars – 67% in the first study and 86% in the second – chose to formulate their deceptive account based on a previously experienced event. Additionally, Nahari, Vrij, and Fisher (2014) found that of their 44 mock criminals who were instructed to provide deceptive statements, more than half indicated that over 20% of their statement was truthful. The use of embedded lies has been observed across various populations, whether it is research participants (Bell & DePaulo, 1996; Leins, Zimmerman, & Polander, 2017), non-criminals engaging in deception (DePaulo et al., 2003), or criminal suspects (Hartwig, Granhag, & Strömwall, 2007).

The embedding of lies into otherwise truthful statements is also reflected in the findings from research examining the strategies interviewees adopt to appear credible (Clemens, Granhag, & Strömwall, 2013; Fiske & Taylor, 2008). For example, Hartwig and colleagues' (2007) examination of guilty and innocent suspects' strategies revealed that one of liars' most endorsed strategies was to avoid lying by telling the truth as much as possible. Interviewees' strategic attempts to be perceived as credible can be explained by the theory of self-regulation, a framework for understanding how people are motivated to control their behaviour to move away from undesired outcomes and to reach desired goals (Carver & Scheier, 2012; Hartwig, Granhag, & Luke, 2014). Liars strategically attempt to edit reality to create a plausible, logical story (Granhag, Strömwall, & Jonsson, 2003; Vrij, Granhag, & Mann, 2010) that may have its foundations in truthful previous experiences. In contrast, innocent interviewees are generally forthcoming and aim to provide full, candid accounts (Hartwig et al., 2007) using their memory to reconstruct what happened.

In the present study, we investigated to what extent truthful and deceptive information interacts to influence detail richness. The rationale for expecting truths and lies to interact is based on research into beliefs about cues to deception. Several studies have shown that people believe inconsistencies are a sign of deception (Blair, Reimer, & Levine, 2018; Vredeveldt, van Koppen, & Granhag, 2014). Consequently, it is not surprising that liars report

to try to maintain consistency as a strategy to appear credible. In general, liars tend to be most concerned with reducing the amount of inconsistencies within the details of their statement compared to any other type of inconsistency (e.g. between-statement or statement-evidence inconsistencies; Deeb et al., 2017, 2018). As a result of their efforts to maintain consistency, liars tend to be equally or more consistent than truth-tellers (Granhag & Strömwall, 2002; Granhag et al., 2003; Vredeveldt et al., 2014), who – as a normal function of memory – may appear inconsistent as information is naturally added or forgotten (e.g. Fisher, Brewer, & Mitchell, 2009).

In one of the only studies to include statements that purposefully contained both truths and lies, Deeb et al. (2017) instructed liars to provide a statement containing reports of a deceptive event and a truthful event during two interviews. When asked about their strategies for appearing credible, nearly half of the liars (45%) reported an attempt to maintain consistency across the interviews for both events. Moreover, many liars reported that they did so by strategically lowering their ‘baseline consistency’ by including fewer repetitions in non-critical portions of the interview. In contrast, only 8% of truth-tellers reported using the consistency strategy (Deeb et al., 2017). Given liars’ focus on consistency, it is plausible that when their statements contain both truthful and deceptive information their efforts to maintain consistency may extend to the richness of information provided.

In sum, lies are rarely complete fabrications. Yet, this is often how they are treated in research (Vrij, 2008a), leaving a significant gap within the deception literature. Examination of statements consisting of both truths and lies could account for individual differences in deceiving (see Vrij, 2016) and provide insight into liars’ verbal behaviour. As such, the objective of the current experiment was twofold. First, we extended the findings of Deeb et al. (2017) to examine how truths and lies interact to influence the consistency of detail richness across elements of a statement. Second, we examined to what extent such interactions are reflected in deceivers’ self-reported strategies. To examine this, the participants in our study provided a statement consisting of two elements. We manipulated the veracity of these elements, with participants either delivering both truthful, both deceptive, or one truthful and the other deceptive element. Based on the general verbal deception literature, we predicted that truthful elements would be richer in detail than deceptive elements (Hypothesis 1). There are two ways in which participants could maintain consistency. First, by calibrating the content of the second element of their statement to that of the first element. This would imply that elements *preceded* by a lie would be less detailed than elements *preceded* by a truth (Hypothesis 2). Second, it is also possible that participants would anticipate the second element, and calibrate the content of the first element to that of the second. Our next prediction was therefore that elements *followed* by a lie would be less detailed than those *followed* by a truth (Hypothesis 3). Finally, we expected that the interaction between lies and truths would be, at least in part, reflected in the participants’ self-reported strategies (Hypothesis 4).

Method

Participants

The sample consisted of 144 native-German speaking undergraduate students (116 females; 28 males) who participated in exchange for either course credit or a €7.50

voucher. A priori power analysis suggested that to achieve an 85% likelihood of detecting a true difference given a medium effect size ($f = .25$; Cohen, 1988), 146 participants were required. To allow for an equal distribution across conditions we opted for 144 participants. All participants were between 18 and 26 years old ($M = 20.81$, $SD = 1.70$), and had not yet received any information on lie-detection or interviewing techniques in their curriculum. The study was approved by the standing ethical committee.

Design

The present study used a 2 (Veracity of the first element [truth, lie]) by 2 (Veracity of the second element [truth, lie]) between-subjects factorial design. Our primary dependent measure was the richness of detail (i.e. quantity of perceptual, spatial, and temporal information combined) in each of the elements separately.

Procedure

Upon arriving to the lab and providing informed consent, participants completed a demographic questionnaire measuring their age, sex, race, native language and education. Afterwards, they received a sealed envelope that contained a letter instructing them to complete no task, one task, or two tasks. The envelope was labelled only by participant number to ensure the researcher was blind to conditions during the interview. Task A consisted of helping to develop a promotional flyer for a café located at the University campus. Participants were instructed to walk across campus to the café and to use the camera provided to take photos that could be included on a flyer to promote the café. In Task B, participants were requested to walk across campus to the bus stop located at the University Medical Centre. Upon arrival, they had to look for a woman named Michelle, of whom they were provided with a photo and informed she would be arriving by bus at some time that day. They were asked to wait for a minimum of five minutes, and to use the notepad and pen provided to write down the information of any buses that arrived or departed during their time. Participants were told to take a photo of Michelle using the camera provided, if they saw her arrive. In reality, Michelle was a fictitious character and participants did not encounter her during the task. Participants were given up to thirty-five minutes to complete their task/s. Both tasks were designed to ensure comparable duration and difficulty, as well as similarities regarding participants' familiarity with the routes and locations.

Participants were randomly assigned to complete no task, one task, or two tasks. For the participants who completed two tasks, the order was counter-balanced. Upon returning to the laboratory after completing their assigned task/s, participants received a second sealed envelope explaining they would be interviewed by the researcher about Tasks A and B and that they were to report and answer questions as if they had completed both tasks. As a result, we created four (between-subject) veracity conditions: Lie-Lie (participants who completed neither of the tasks), Lie-Truth and Truth-Lie (participants who completed either Task A or Task B), and Truth-Truth (participants who completed both tasks). The instruction letter contained a brief description of what Tasks A and B entailed to allow those who did not complete one or both of the tasks to familiarize themselves with what they would be reporting (see Supporting Information). This also allowed liars

to know, in advance of providing their statement, during which element/s of their statement they were required to lie. Participants were told it was important to be convincing because (i) it would prevent them from having to stay an additional twenty minutes to provide a written account and (ii) it would earn them a chance to win a €50 raffle. After receiving these instructions, participants were given ten minutes alone to prepare.

Next, participants underwent a structured, information-gathering style interview (see Supporting Information). The interviews were audio recorded. At the outset of the interview, the researcher stated that her goal was to obtain as much information as possible, and to determine the participant's credibility. The researcher also reminded participants that she was blind to the veracity condition, and instructed them to report as many details as possible, even if they did not think they were important. Each interview began with the elicitation of a free narrative of the participants' activities during the first task. The researcher then asked a series of questions such as 'What else can you tell me about this task?', 'How long did this task take you?', 'Did anything unexpected happen?' The same procedure was repeated for the second task. Afterwards, the researcher gave participants an opportunity to provide any missing information regarding either task.

Following the interview, participants completed the Post-Interview Questionnaire. They were asked to rate several items on 5-point Likert scales (1 – strongly agree to 5 – strongly disagree): (i) I felt motivated to convince the interviewer that I completed both tasks, (ii) I had enough time to prepare for the interview, (iii) I prepared my statements strategically¹, (iv) I was successful in convincing the interviewer that I completed both tasks, (v) I think I will have to stay longer to provide a written statement. Participants then responded to two open-ended questions regarding their strategies for convincing the interviewer of their credibility and their strategic preparation. As well, participants responded to two multiple-response questions that asked them to select the verbal strategies (e.g. forthcomingness, avoidance, telling a plausible or clear statement, providing unverifiable details; see Table 2) and nonverbal strategies (e.g. maintaining eye contact, not fidgeting, appearing calm) they used when reporting each of the tasks separately. After completing the questionnaire, participants were debriefed and the experiment was concluded. None of the participants were asked to stay longer to provide a written statement and all participants were included in the raffle. The experiment lasted approximately one hour.

Coding

Verbal content analysis. The audio recorded interviews were transcribed verbatim. The first author trained two coders, both of whom were blind to the veracity of the statements. These coders assessed the statements for detail richness, represented by the sum of three types of detail; specifically, (1) perceptual details: Information about what the interviewee saw (e.g. 'She wore a red blouse'), heard (e.g. 'He talked loudly'), smelled (e.g. 'It smelled like fresh cookies'), tasted (e.g. 'It was bitter'), or felt (e.g. 'The sunshine was warm') during their activities; (2) spatial information: Information about locations (e.g. 'On the elevator') or the spatial arrangement of people and/or objects (e.g. 'The cups were on the bar'); and (3) temporal information: Information about when the activities or event happened (e.g. 'It was 10:00am'), duration of an activity (e.g. 'It took me six minutes to walk there'), or an explicit description of a sequence of events (e.g. 'After getting my coffee, I left'). For each participant, the coders marked all perceptual, spatial, and temporal

details individually in the text, and tallied the frequency of occurrence of each of these details for the element of the statement dealing with Task A and Task B individually. This coding scheme is publically available on the Open Science Framework.

The main coder and the second coder coded a randomly selected 20% of the statements in order to establish reliability. Inter-rater reliability between the two coders for each of the criteria in the total statements, using the two-way random effects model measuring consistency (e.g. Koo & Li, 2016; Vrij, Leal, Jupe, & Harvey, 2018), was high for perceptual information (Single Measures, Intraclass correlation coefficient, $ICC = .91$), spatial information ($ICC = .89$), and temporal information ($ICC = .75$). After confirming the reliability between the two coders, the second coder rated an additional 17 statements, and the main coder completed the remaining sample of participants' statements.

For our analyses, we calculated a total *richness of detail* score by summing the number of perceptual, spatial, and temporal details for the elements of the statement relating to Task A and Task B separately.

Finally, we also coded for the clarity of statements (i.e. relating to RM; Johnson & Raye, 1981; Vrij, 2008a). This criterion was scored as present (1) if the statement was clear, sharp and vivid and scored as absent (0) if the statement was vague and dim. As well, we coded for the plausibility of statements and for the presence of unexpected complications. The latter two variables are not reported in the manuscript because we observed floor effects for each variable and therefore cannot report reliable data.

Strategies. To code the participants' self-reported strategies, one main coder examined the open-ended responses to establish data-driven categories (see Masip & Herrero, 2013). This entailed a multi-stage process that began by identifying each participant's strategy or strategies, then grouping together overlapping responses, and gradually condensing these responses into key categories based on conceptual similarities. The first author oversaw each stage of this process and decided upon the final categories. A total of eight categories emerged from this coding method (see Table 1).

The main coder and a second coder then coded a randomly selected 20% of the participants' open-ended responses in order to establish inter-rater reliability regarding the classification of responses into the appropriate categories. After confirming that the raters were consistent (Single Measures $ICCs$ ranging from .55 to 1.00)², the main coder completed the remaining sample of participant responses and only these scores were used in the analysis.

In addition to coding participants' interview strategies, we also examined their self-reported methods of interview preparation. The same qualitative coding method as above was used for preparation coding. Inter-rater reliability was excellent (Single Measures $ICCs$ ranging from .95 to 1.00). The main coder's scores for the entire sample were used in the analyses.

Analysis

To test whether the participants calibrated the richness of details of the elements according to the veracity of the preceding or following element, we conducted two 2×2 ANOVAs. First, we tested the effect of the first element on the second by submitting

Table 1. Frequency and percentage of overall interview strategies across veracity conditions.

Interview Strategy	Condition			
	Truth-Truth	Lie-Lie	Truth-Lie	Lie-Truth
Provide a detailed, plausible account	21 (40.38)	22 (30.99)	27 (38.03)	25 (38.46)
Strategic control of behaviour	5 (9.62)	18 (25.35)	12 (16.90)	9 (13.85)
Manipulate verbal content:				
General linguistic control	1 (1.92)	9 (12.68)	8 (11.27)	7 (10.77)
Manipulate verbal content:				
Include truthful details	5 (9.62)	11 (15.49)	2 (2.82)	5 (7.69)
Use imagination to deliver the statement	2 (3.85)	5 (7.04)	5 (7.04)	9 (13.85)
Manipulate verbal content:				
Maintain consistency between elements	0 (0)	0 (0)	11 (15.49)	8 (12.31)
No strategy	7 (13.46)	6 (8.45)	4 (5.63)	1 (1.54)
Provide a truthful account	11 (21.15)	0 (0)	2 (2.82)	1 (1.54)
Total frequency count per condition	52	71	71	65

Note: The numbers reported represent the frequency occurrence of each strategy. The respective percentage within each condition is presented in brackets. Frequencies may add up to over 36 (the number of participants in each condition) because each participant could report multiple strategies that may have fallen into one or more categories. The bolded numbers represent the categories with the two largest percentages per veracity condition.

the richness of details in the second element to a 2 (veracity of the second element: [truth, lie]) \times 2 (veracity of the first element: [truth, lie]) between-subjects ANOVA. Second, we tested the effect of the second element on the first element by submitting the richness of details in the first element to a 2 (veracity of the first element: [truth, lie]) \times 2 (veracity of the second element: [truth, lie]) between-subjects ANOVA. Additionally, the data were examined by calculating a Bayesian ANOVA with default prior scales (i.e. r scale fixed effects at 0.5), using JASP. We report the Bayesian factors (BF ; e.g. Lee & Wagenmakers, 2013) in line with the guidelines by Jarosz and Wiley (2014), adjusted from Jeffreys (1961). The approximate evidence categories are as follows: Positive values between 1 and 3 indicate weak evidence for the alternate or null hypothesis, values between 3 and 10 indicate substantial evidence, values between 10 and 20 constitutes strong or very strong evidence, and values above 20 are considered very strong or decisive evidence. Evidence for the interaction term was calculated by dividing the interaction model by the main factors (e.g. Wagenmakers et al., 2016). For ease of interpretation, BF_{10} is used to indicate the Bayes factor as evidence in favour of the alternative hypothesis, whereas BF_{01} is used to indicate the Bayes factor as evidence in favour of the null hypothesis.

Results

Motivation, preparation, & self-perceived success

Participants reported to have been highly motivated and to have had enough time to prepare for the interview, with no significant differences between veracity groups. Significant differences emerged between conditions in terms of strategic preparation and self-perceived success. Participants reported more strategic preparation for deceptive elements of the statements than for truthful elements. Additionally, participants who first reported deceptive elements were more likely than any other group to believe that

they would have to stay longer to provide a written statement. To conserve manuscript length, the exact analyses are reported in the Supporting Information.

Interview preparation techniques

Across veracity conditions, four preparation techniques emerged from our qualitative coding of participants' responses. Participants in the Lie-Lie condition reported the highest overall frequency of preparation techniques whereas those in the Truth-Truth condition reported the lowest. The respective endorsement of the four techniques was similar across veracity conditions, with the most frequently endorsed technique being to 'Use imagination to prepare the statement', followed by 'Strategically preparing the statement and/or responses', 'Purposefully manipulating the content of the statement', and 'Other or miscellaneous'. The exact analyses are reported in the Supporting Information.

Statement clarity

Veracity significantly influenced the perceived clarity of both the first and second element of interviewees' statements only when they were reporting entirely truthfully or entirely deceptively, with truthful statements being evaluated as more clear than deceptive statements. The complete analyses are presented in the Supporting Information.

Richness of detail

Confirmatory analyses

To test whether elements preceded by a lie would be less detailed than elements preceded by a truth (Hypothesis 2) we conducted a 2 (veracity of the second element: [truth, lie]) \times 2 (veracity of the first element: [truth, lie]) between-subjects ANOVA on the richness of details in the second element. This analysis revealed a main effect of veracity of the second element, $F(1, 140) = 10.98, p = .001, \eta_p^2 = .073; BF_{10} = 22.00$, with truthful elements ($M = 34.76, SD = 18.26, 95\% \text{ CI } [31.00, 38.53]$) scoring higher on richness of details than deceptive elements ($M = 25.85, SD = 14.11, 95\% \text{ CI } [22.09, 29.61]$). The main effect of the veracity of the first element was not significant, $F(1, 140) = 3.01, p = .085, \eta_p^2 = .021; BF_{01} = 1.57$, meaning that the elements preceded by a lie ($M = 27.97, SD = 17.07, 95\% \text{ CI } [24.21, 31.73]$) were not significantly less rich in detail than elements preceded by a truth ($M = 32.64, SD = 16.45, 95\% \text{ CI } [28.88, 36.40]$). Finally, the interaction effect was also not significant, $F(1, 140) = 2.00, p = .160, \eta_p^2 = .014; BF_{01} = 1.74$, indicating the veracity of the first element had no differential effect on the richness of detail score of the second element. Taken together, we received support for Hypothesis 1, that truthful elements are richer in detail than deceptive elements; however, we did not show support for our second hypothesis, that interviewees would calibrate the content of the second element to that of the first (Figure 1).

To investigate whether participants calibrated the first element according to the second element (Hypothesis 3) we conducted a 2 \times 2 (veracity of the first element: [truth, lie]) \times veracity of the second element: [truth, lie]) between-subjects ANOVA on the richness of details in the first element. The main effect of veracity of the first element was significant, $F(1, 140) = 9.45, p = .003, \eta_p^2 = .063; BF_{10} = 10.79$, with truthful elements ($M = 35.71, SD =$

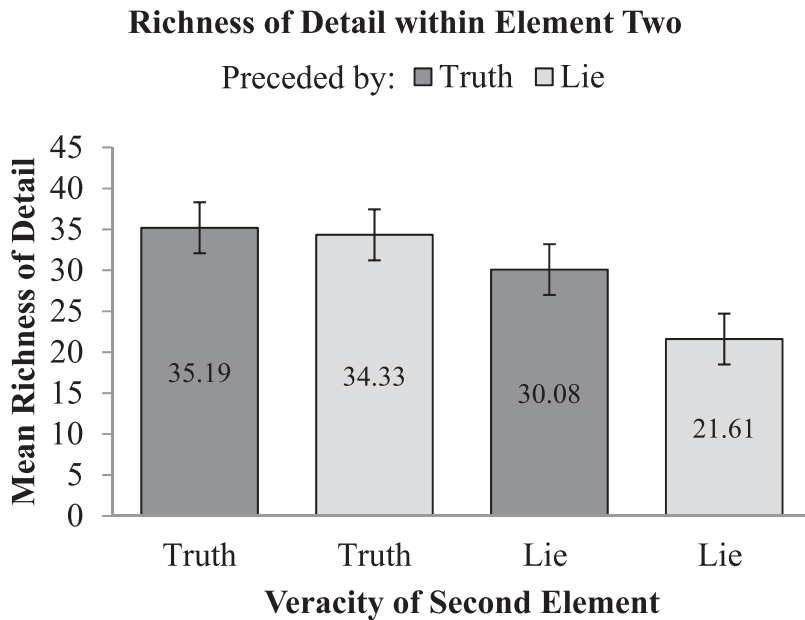


Figure 1. Mean richness of details in element two as a function of veracity condition. Standard errors are represented by the error bars attached to each symbol.

14.42, 95% CI [32.75, 38.67]) being richer in detail than deceptive elements ($M = 29.19$, $SD = 11.27$, 95% CI [26.23, 32.16]). The main effect of veracity of the second element was also significant, $F(1, 140) = 5.60$, $p = .019$, $\eta_p^2 = .038$; $BF_{10} = 1.95$, with the elements followed by a lie ($M = 29.94$, $SD = 13.48$, 95% CI [26.98, 32.91]) scoring lower on richness of details than the elements followed by a truth ($M = 34.96$, $SD = 12.73$, 95% CI [32.00, 37.92]). Lastly, the interaction effect was not statistically significant, $F(1, 140) = 1.50$, $p = .222$, $\eta_p^2 = .011$; $BF_{01} = 2.12$, indicating the veracity of the second element had no differential effect on the richness of detail score of the first element. Overall, we found additional support for Hypothesis 1, that truthful elements are richer in detail than deceptive elements, and we supported our third hypothesis, that interviewees would calibrate the content of the first element to that of the second (Figure 2).

Exploratory analyses

As we were specifically interested in how lies are influenced by truthful information, we also carried out two exploratory independent-samples t -tests comparing the richness of details of lies only. We corrected for inflated type 1 error probability by applying a Bonferroni correction dividing the alpha of .05 by two, resulting in a significance level of .025. We found a statistically significant difference in mean richness of detail score of the deceptive second element between those preceded by a truth versus by a lie, $t(70) = -2.66$, $p = .010$; $BF_{10} = 4.64$, with those preceded by a lie ($M = 21.61$, $SD = 10.45$, 95% CI [14.80, 28.42]) being significantly less rich in detail than those preceded by a truth ($M = 30.08$, $SD = 16.05$, 95% CI [23.27, 36.89]). There was also a statistically significant difference in mean richness of detail score between deceptive first elements followed by a truth versus by a lie, $t(66.34) = -3.03$, $p = .004$; $BF_{10} = 10.81$, indicating that a lie followed by another lie

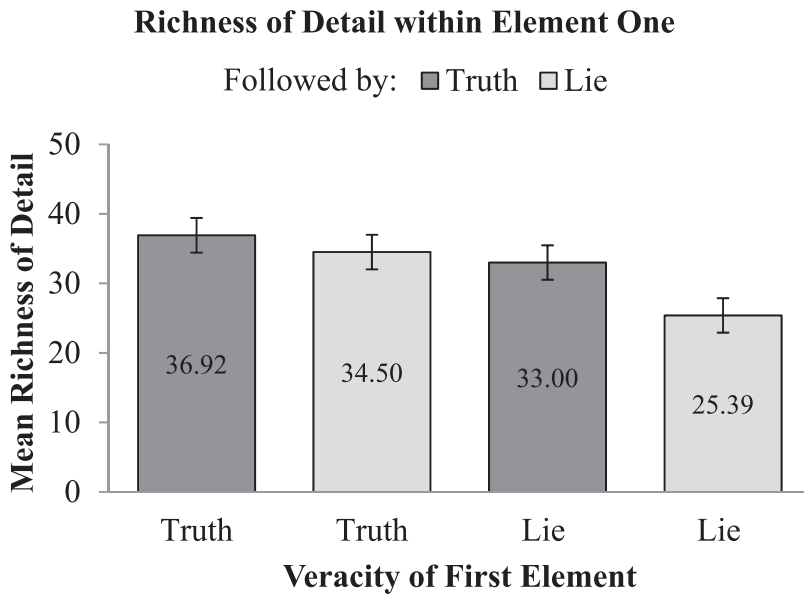


Figure 2. Mean richness of details in element one as a function of veracity condition. Standard errors are represented by the error bars attached to each symbol.

($M = 25.39$, $SD = 9.34$, 95% CI [21.20, 29.58]) was significantly less detailed than a lie followed by a truth ($M = 33.00$, $SD = 11.86$, 95% CI [28.81, 37.19]).

Interviewees' strategies

The vast majority of interviewees reported using strategies to enhance the likelihood that they would be perceived as credible: 95.49% of participants reported using one or more verbal strategies (e.g. telling a plausible story, keeping the statement clear and simple, reporting from previous memory; see Table 2) and 92.02% indicated using at least one nonverbal strategy (e.g. maintaining eye contact, not fidgeting, appearing confident, etcetera) during their interview. In this section, we will concentrate our reports primarily on the verbal strategies relating to our consistency hypotheses.

Overall interview strategies

Table 1 provides an overview of the data derived from the coding of participants' open-ended responses regarding their overall interview strategies. Across all veracity conditions, the most frequently mentioned verbal interview strategy was to 'Provide a detailed and plausible account' (36.68% of all reported strategies). Only 7.34% of the reports fell into the category of 'Manipulating the verbal content by maintaining consistency between the statement elements' (e.g. matching the type and quantity of details provided in both elements, adapting the deceptive story to the truthful story or vice versa, etcetera). As shown in Table 1, only participants in the Truth-Lie and Lie-Truth conditions reported strategies relating to maintaining consistency between their statements, with no significant difference in mean scores for endorsing the consistency strategy between these two conditions, $t(70) = 0.70$, $p = .486$; $BF_{01} = 3.33$. Thus, participants in the mixed veracity

Table 2. Frequency of verbal strategy endorsement for element one and two across conditions.

Interview strategy	Condition				Total
	Truth-Truth	Lie – Lie	Truth-Lie	Lie-Truth	
Strategies for Element One					
Forthcomingness	30	8	29	11	78
Telling a plausible story	13	24	12	23	72
Providing details the investigator cannot check	10	21	15	25	71
Keeping the statement clear and simple	17	21	11	15	64
Reporting from previous experience/ memory	6	22	7	19	54
Outright fabrication	1	11	2	18	32
Avoidance	3	12	5	10	30
Other	2	0	0	1	3
None	1	0	0	0	1
Total frequency counts	83	119	81	122	405
Strategies for Element Two					
Telling a plausible story	8	26	29	12	75
Providing details the investigator cannot check	10	21	21	15	67
Keeping the statement clear and simple	13	22	13	18	66
Forthcomingness	28	7	9	21	65
Matching the amount of details in statements	9	13	21	22	65
Matching the type of details in statements	8	12	19	16	55
Reporting from previous experience/ memory	8	12	19	8	47
Outright fabrications	5	9	13	1	28
Avoidance	2	14	8	7	31
Other	1	1	0	1	3
None	2	1	0	2	5
Total frequency counts	94	138	152	123	507

Note: The numbers reported represent the frequency of participants who endorsed each strategy.

conditions reported similarly (albeit infrequent) strategic attempts to match the consistency of their reports, whereas participants who fully lied or fully told the truth, did not report to utilize such a strategy.

Interview strategies for individual statement elements

We were also interested in interviewees' strategies, relative to each element of the statement individually. We asked participants to indicate which strategies they used for their reports of each Task A and Task B separately from a predetermined response set of multiple verbal strategies (see Table 2). Regarding the strategies for the second element of their statements, one of the most frequently endorsed strategies by participants in the Truth-Lie condition was '*Matching the amount of details in statements*' (13.82% of the endorsed strategies among this condition). Similarly, the same matching strategy was the most frequently endorsed strategy by participants in the Lie-Truth condition (17.89% of the endorsed strategies among this condition). This provides partial support for our prediction that interviewees in the mixed veracity conditions would report having strategically calibrated their verbal content based on the veracity of the preceding element. Taken together, these findings contribute partial support to Hypothesis 4, which predicted that the interaction between lies and truths would be, at least in part, reflected in participants' self-reported strategies.

Discussion

In line with previous research (e.g. Amado et al., 2016; DePaulo et al., 2003; Vrij, 2008a), we found support for our hypothesis that truthful elements are richer in detail than deceptive

elements (Hypothesis 1). We also found evidence that truthful and deceptive information interacts to influence detail richness: (i) Elements followed by a lie were less detailed than elements followed by a truth (Hypothesis 3), and (ii) deceptive elements became more detailed when flanked by a truth than when flanked by a lie.

Participants only calibrated the detail richness of the first element based on the veracity of the second element. An explanation for this could be that participants knew, prior to the interview, whether they would be deceptive or honest about each element of the statement. When participants anticipated having to tell a lie in the second element of their statement, they may have already focused their efforts on this from the beginning of their interview (Jundi, Vrij, Hope, Mann, & Hillman, 2013). The directed attention of their cognitive resources towards ensuring the latter element of the statement was perceived as credible may have impaired the detail richness of the former element of the statement. This directed attention could even provide an alternative explanation for the differences in detail richness between lies and truths. Given that these lies are most likely to actually consist of a mixture of truths and lies, it may not be memory processes, but directed attention that can account for the typical finding that lies are less detailed than truths.

We did not find support for our prediction that elements preceded by a lie would be less detailed than elements preceded by a truth (Hypothesis 2). Yet, our exploratory tests of lies only did reveal that participants calibrated their lies according to both the preceding and the following element, with deceptive elements becoming more detailed when flanked by a truth than when flanked by a lie. The discrepancy between these two findings may mean we had insufficient power to detect the main effect and/or interaction in the omnibus test. This is supported by the Bayes factors of 1.57 and 1.74, supplying only weak evidence for the absence of such effects. However, the results of the exploratory tests suggest that liars were intentionally calibrating the detail richness of their lies to that of the truths, perhaps to avoid noticeable inconsistencies between the truthful and deceptive elements of the statement. Future studies could examine whether this effect replicates, and if so, how lies become richer in detail.

From a motivational perspective, participants in the mixed veracity conditions had the same task: Providing a statement with one truthful element and one deceptive element. As a strategy, they could either (i) boost the richness of details within the deceptive element making it resemble the truthful part, or (ii) reduce the detail richness within the truthful element to make it resemble the deceptive element. Our exploratory findings – that participants in the Truth-Lie and Lie-Truth conditions provided more details than participants in the Lie-Lie condition – suggest that interviewees applied the first strategy, increasing the detail richness of the deceptive element to match that of the truthful element. More broadly, the order of presenting the truths and lies within statements, and not solely the veracity, could have influenced the richness of details provided by participants in the mixed veracity conditions. Specifically, interviewees may have preferred to begin by telling the truth and to integrate their lie midway through the statement, a pattern previously observed in a study examining deception within an insurance claim setting (Leal, Vrij, Nahari, & Mann, 2016). The tendency for insurance claimants to begin by reporting truthfully and to tell their lies as the interview progressed may have been an attempt to gain the investigator's trust or to become more comfortable with the interview setting and investigator. There may also have been a cognitive reason:

Beginning with a lie increases cognitive demand meaning that interviewees have to formulate and intentionally activate a plausible lie while suppressing the truth (e.g. Vrij, 2015), during an unfamiliar situation. Future research should continue teasing apart the motivational and cognitive processes of liars who report both truthful and deceptive information within one statement.

We found only limited support for our prediction that the differences in the richness of details in statements would be reflected in participants' strategies (Hypothesis 4). Participants in the mixed veracity conditions reported similar, albeit infrequent, attempts to match the consistency of their statements, and participants who fully lied or fully told the truth, did not utilize such a strategy. The relatively low number of participants reporting to have used a consistency strategy corresponds to the modest effect sizes found in our quantitative analyses. As argued by Ericsson and Simon (1980), when asking participants to make retrospective judgements regarding their behaviour, inconsistencies can arise because of the experimental procedures, particularly when using questions that are too general to prompt the information actually sought. Since we asked broad strategy questions, this could have led to less accurate responses.

Our research was not without limitations. First, we examined the effect of two elements immediately following each other. This is appropriate to establish whether an effect appears, but future research could utilize a less artificial paradigm that better translates to applied contexts; for example, examining statements with lies and truths dispersed throughout. Similarly, our results may not generalize to situations in which the liar is unable to anticipate the exact topic or direction of the interview, such as when unexpected questions are asked. Perhaps in such situations, participants' strategic attempts to maintain consistency would not calibrate predominantly in the direction of the following element. Third, we cannot conclude that participants, who were instructed to lie, provided lies that were entirely untruthful. In fact, in the current study, participants across veracity conditions reported to have strategically included truthful details they had drawn from previous experiences and/or memory. Hence, we are left with deceptive statements that may be, realistically, a combination of truths and lies, which may have weakened the strength of the observed effects. Indeed, participants in the mixed veracity conditions may have easily borrowed truthful details from their experience of the completed task for their descriptions of the fabricated task, whereas complete liars may not have experienced any event rich in detail during the allotted time. This strengthens the argument that liars in the mixed veracity conditions draw on recent truthful previous memories to calibrate their statements whereas liars who provide entirely deceptive accounts may not. Fourth, the focus of this study was on one particular aspect of statement consistency: Consistency in detail richness. It is also possible that the elements of participants' statements were consistent, or inconsistent, on other dimensions than detail richness, such as linguistic characteristics.

Another consideration is that the emotional pressure experienced by liars during actual investigative interviews is conceivably much higher than during psychological experiments. Additionally, nearly 80 percent of our sample was female, a disproportion that may also impact the generalizability of our findings since the majority of perpetrators that come to the attention of the criminal justice system are male (e.g. Heimer & Lauritsen, 2008; U.S. Department of Justice, 2009). However, it is unlikely that stakes or gender robustly influenced our results since the same theoretical assumptions and strategies should apply across low and high stakes contexts and for males and females.

We observed floor effects for the variables regarding unexpected complications and plausibility. One potential explanation is that the presence of complications may be situation-related. The low rate of reported complications in our sample could be because the reports were about short encounters scripted by the researcher, as opposed to longer activities initiated by the participant (e.g. Vrij et al., 2018). Additionally, the statements may have been judged as implausible since they were about unique experimental tasks as opposed to more believable day-to-day activities.

The research presented in this manuscript has two practical implications. First, our results show that liars are able to calibrate the detail richness of their lies to that of their truths. This presents a possible threat to the diagnostic accuracy and utility of verbal credibility assessment tools if liars are able to provide lies that mirror the richness of detail in the truthful components of their statement (e.g. Gnisci, Caso, & Vrij, 2010; Leins et al., 2017; Nahari, Vrij, & Fisher, 2012).

A second practical implication relates to the baseline technique. Baselining refers to the practice in which interviewers evaluate the veracity of a critical component of a statement relative to a baseline, or neutral, component of the same statement (see Vrij, 2016 for an overview). Baselining is frequently used by police in practice (Ewens, Vrij, Jang, & Jo, 2014; Frank, Yarbrough, & Ekman, 2006; Inbau, Reid, Buckley, & Jayne, 2013). This approach encourages starting an interview with a neutral – and often truthful – part. Our findings indicate that interviewees calibrate the detail richness of the initial component of their statement based on the veracity of the following component. Therefore, if suspects manipulate the richness of details provided in their initial baseline statement to be consistent with the detail richness provided in their subsequent reports, then potential truth-lie differences may disappear. A possible preventative measure is for lie detectors to control for the event and to ask about the same event multiple times in different formats (e.g. first obtaining an oral account and then a sketch), using the first statement as a baseline (Vrij, 2016).

In sum, the current study addressed if and how truthful and deceptive information interacts to influence the richness of details in statements, and how this is reflected in individuals' strategies. The results indicate that interviewees calibrate the richness of detail provided in the first element of their statement based on the veracity of the following element, however, this effect was not robustly reflected in interviewees' self-reported strategies. Moreover, it seems that participants calibrate their lies according to both the preceding and the following element, with lies becoming more detailed when flanked by truthful information.

Notes

1. One participant's response to this question was not recorded via Qualtrics and therefore the results to this specific question are based on $N = 143$.
2. The average ICC across the eight strategies categories was .80. Two categories, relating to general linguistic control and behavioural control, had low to moderate inter-rater reliability.

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ORCID

Brianna L. Verigin  <http://orcid.org/0000-0001-8941-8398>

Ewout H. Meijer  <http://orcid.org/0000-0001-9590-3699>

Aldert Vrij  <http://orcid.org/0000-0001-8647-7763>

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