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Embedding lies into truthful stories does not affect their quality

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Summary

When given the opportunity, liars will embed their lies into otherwise truthful statements. In what way this embedding affects the quality of lies, however, remains largely unknown. This study investigated whether lies that are embedded into truthful stories are richer in detail and contain higher quality details compared to lies that are part of entirely fabricated statements. Participants (N = 111) were asked to provide a statement that was either entirely truthful, entirely fabricated, or had the fabricated element of interest embedded into an otherwise truthful story. Results indicated that lies embedded in a fabricated statement are not qualitatively different from lies embedded in an otherwise truthful statement. Supporting Bayes factors provided moderate to strong evidence for this conclusion. Accordingly, verbal credibility assessment tools based on the verbal content measured in this study may be robust against the embedding of lies.

KEYWORDS
content analysis, deceivers' strategies, embedded lies, information management, verbal deception detection

Whereas people typically report to rely on nonverbal behaviour to detect deception (Vrij, 2008), the accuracy of credibility assessments actually improves when judges rely only on the verbal content of a statement (Bond & DePaulo, 2006). Moreover, good lie detectors report a higher reliance on verbal cues when making credibility judgments, while poor lie detectors tend to rely primarily on nonverbal cues (Mann, Vrij, & Bull, 2004). Specifically, the most consistent finding in the verbal deception literature is that truthful statements contain more details than deceptive ones (e.g., Amado, Arce, Fariña, & Vilarino, 2016; DePaulo et al., 2003; Luke, 2019; Oberlander et al., 2016). A recent meta-analysis estimated this effect at d = 0.55 (Amado et al., 2016), while additional meta-analytical findings support the usefulness of temporal, visual, and auditory details for differentiating truthful from false accounts (Masip, Sporer, Garrido, & Herrero, 2005).

In studies investigating the effect of deception on the content of statements, participants are typically instructed to report a truthful account, or to fabricate one. Real-life deceptive statements will, however, rarely be complete fabrications, as liars prefer to embed their lies into otherwise truthful statements (e.g., Leins, Fisher, & Ross, 2013; Nahari, 2018a; Nahari & Vrij, 2015; Vrij, 2008; Vrij, Granhag, & Porter, 2010). Yet, it remains unknown how embedded lies are influenced by surrounding truthful information. Reason to believe that the embedding of lies affects their quality stems from research on beliefs about cues to deception and liars' strategies. This research suggests that laypeople and legal professionals alike believe that inconsistency is symptomatic of deception (Blair, Reimer, & Levine, 2018; Strömwall & Granhag, 2003; Vredeveldt, van Koppen, & Granhag, 2014). Accordingly, one of the main concerns of liars—and one of their most frequently reported strategies—is to maintain consistency (Deeb et al.,

2017; Hartwig, Granhag, Strömwall, & Doering, 2010). Specifically, Deeb et al. (2017) instructed liars to provide a statement containing a mix of a deceptive event and a truthful event. When asked about their strategies for appearing credible, 45% of liars mentioned maintaining consistency, and many liars reported to have maintained consistency by strategically lowering their "baseline consistency" by including fewer repetitions in specific portions of the interview.

If participants would successfully maintain consistency when embedding their lies into an otherwise truthful statement, their lies could become more richly detailed when surrounded by truthful information. Indeed, recent research compared how interviewees strategically regulate the information they provide when their accounts contain one truthful and one deceptive component and found that lies became more richly detailed when preceded or followed by truthful information compared to when preceded or followed by other lies (Verigin, Meijer, Vrij, & Zauzig, 2019). The present study aimed to extend these findings by examining the extent to which the embedding of lies into otherwise truthful stories affects the quality of information. In line with previous research (e.g., Amado et al., 2016; DePaulo et al., 2003; Luke, 2019; Masip et al., 2005), we predicted that *completely truthful* statements would be richer in detail compared to *completely fabricated* statements (Hypothesis 1). Based on our consistency assumption, we also predicted that *lies embedded into an otherwise truthful statement* would be richer in details than *lies embedded into an entirely fabricated statement* (Hypothesis 2).

Besides the differences in detail richness, we also investigated whether the consistency hypothesis extends to a number of other content cues that have been shown diagnostic of deception (see Table 1). As secondary cues, we first examined the amount of verifiable information. This cue stems from the Verifiability Approach (VA; Nahari et al., 2014a, 2014b), which works on the assumption that liars, on the one hand, are inclined to provide detailed statements to be perceived as cooperative and credible, but, on the other hand, want to minimize the chances that investigators can falsify their statement (Masip & Herrero, 2013; Nahari et al., 2014a). A strategy that meets these aims is to provide information that cannot be verified.

Second, we examined liars' tendency to report fewer complications—occurrences that make a situation more difficult than necessary, often characterized by disrupted activity or failing efforts (e.g., missing the bus; Steller & Köhnken, 1989; Vrij, Leal, Jupe, & Harvey, 2018)—compared to truth tellers. This makes sense given liars' preference for simple stories (Hartwig, Granhag, & Strömwall, 2007). We also investigated common knowledge details (i.e., strongly invoked stereotypical information about events; Vrij, Leal, Mann, et al., 2018). Whereas truth tellers have personal, unique experiences of an event (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996), liars typically lack such information and their reports tend to be characterized by more general, impersonal knowledge (Sporer, 2016). Another cue relates to self-handicapping strategies (i.e., implicit or explicit justifications as to why someone is unable to provide certain information; Vrij, Leal, Mann, et al., 2018). Although liars prefer to keep their stories simple, they also realize that admitting a lack of knowledge and/or memory may generate suspicion from investigators (Ruby & Brigham, 1998). Liars, then, are inclined to provide justifications for their inability to provide certain information.

Lastly, we explored the clarity and plausibility of statements. Clarity, or vividness, refers to the extent to which a statement is clear, sharp, and vivid (instead of dim and vague; e.g., Sporer, 2004). How plausible a statement is refers to whether the story is probable, realistic, and makes sense. Both critera derive from the reality monitoring method of credibility assessment (RM; Johnson & Raye, 1981), which reasons that truthful accounts represent experienced memories and are likely to be, for example, more clear and plausible compared to lies, which are formed from imagination. There is previous empirical support regarding these critera (DePaulo et al., 2003; Leal et al., 2015; Sporer & Küpper, 1995; Zhou et al., 2004).

Altogether, our secondary hypotheses were that *completely truthful* statements would be characterized by more verifiable details, a higher proportion of complications, and higher ratings of statement clarity and plausibility compared to *completely fabricated* statements (Hypothesis 3), and that *lies embedded into an otherwise truthful statement* would be characterized by these higher quality details moreso

TABLE 1 Previous research findings regarding content cues of liars' and truth tellers' statements

Veracity cue	Direction of support	Evidence base
Verifiability of details	More prevalent in truthful statements	Nahari, 2018b; Harvey, Vrij, Nahari, & Ludwig, 2016; Nahari, Vrij, & Fisher, 2014a, 2014b.
Complications	More prevalent in truthful statements	Vrij, Leal, et al., 2017; Vrij et al., 2018; Vrij, Leal, Jupe, & Harvey, 2018; Vrij et al., 2018.
Common knowledge details	More prevalent in deceptive statements	Sporer, 2016; Volbert & Steller, 2014; Vrij et al., 2017.
Self-handicapping strategies	More prevalent in deceptive statements	Vrij et al., 2017; Vrij, Leal, Fisher, et al., 2018; Vrij, Leal, Jupe, & Harvey, 2018; Vrij, Leal, Mann, et al., 2018.
Statement clarity	More prevalent in truthful statements	Johnson & Raye, 1981; Sporer & Küpper, 1995.
Statement plausibility	More prevalent in truthful statements	DePaulo et al., 2003; Leal, Vrij, Warmelink, Vernham, & Fisher, 2015; Zhou, Burgoon, Nunamaker, & Twitchell, 2004.

than *lies embedded into an entirely fabricated statement* (Hypothesis 4; see Table 1).

1 | METHOD

1.1 | Participants

The sample consisted of 111 undergraduate students, graduate students, and staff members, who were all naïve to forensic psychology (92 females; 19 males; M_{age} = 21.91 years; SD_{age} = 4.25). An apriori power analysis indicated that this number of participants was required to achieve an 80% likelihood of detecting a true difference given a medium effect size. All subjects participated in exchange for course credit or a £5 voucher and the opportunity to win a £50 raffle. Eligible participants were native-English speakers, aged 18 years or older. The study was approved by the standing ethical committee and was preregistered and approved via the Open Science Framework (OSF): http://j.mp/2D60QWu.

1.2 | Procedure

Upon arriving to the lab and providing informed consent, participants completed a Pre-Interview Questionnaire followed by a demographic form measuring their age, sex, ethnicity, education, and native-language. Participants then received a letter instructing them to imagine that they had been called into a police interview as a suspect in a home invasion investigation, and that they must provide an alibi for their whereabouts during the day of the crime. Three conditions were created by providing participants with additional instructions. First, truth tellers were told that they were innocent, and their task was to convince the interviewer of their innocence by providing a completely truthful alibi. In addition, two lie conditions were created. Liars were told to imagine they were guilty of the hypothetical crime in question, and that they must lie about their whereabouts during the time of the home invasion, that took place between 1:00 p.m. and 3:00 p.m. Embedded liars were instructed to embed the critical 1:00 p.m. to 3:00 p.m. period in an otherwise truthful account, whereas in the complete lie condition, liars were asked to fabricate the entire account (see Supporting Information for the instructions). All participants were told it was important to be convincing because it would earn them a chance to win a £50 voucher and it would prevent them from having to stay an additional twenty minutes to provide a written account. After receiving these instructions, participants were given up to ten minutes alone to prepare.

The assignment to either the truthful, embedded lie, or complete lie condition was done in a pseudo-random manner. The first five of every fifteen participants were assigned to the truth teller condition, whereas the remaining participants (e.g., participants 6 to 15, 21 to 30, etcetera) were assigned to either the embedded lie or complete lie conditions. This was done so we could match the content of the critical period in the two lie conditions to that in the truth teller condition. Specifically, the alibi activity that participants were instructed to lie about was generated based on the truth tellers' responses to the Pre-Interview Questionnaire that asked them to briefly describe, in approximately one sentence, their activities between 1:00 p.m. and 3:00 p.m. on the previous three days. The first author selected the activity that had the most unique, contextual detail, and this selected activity was used for all three conditions, while making sure the assigned alibi activity differed from any of the liars' reported events. This pseudo-randomized design allowed us to experimentally control the type of activity reported and length of time between the experience and reporting (i.e., one, two or three days) across participants, thereby reducing heterogeneity across statements.

Next, a second researcher (blind to participants' conditions) began the interview by stating that her goal was to obtain as much information as possible, and to determine how credible the participant's account was. The interviewer instructed the participant to report as many details as possible, even if she/he did not think they were important. Each interview followed a structured format (see Supporting Information) and was video-recorded. The interview began with the elicitation of a free narrative of the participants' activities from morning to evening on the day in question. The researcher then asked several questions, such as "What else can you tell me about that day?", "Did anything unexpected happen or perhaps something that did not go as planned?" Interviewees were also asked to report their activities during the 1:00 p.m. to 3:00 p.m. period specifically and were given the opportunity to provide any forgotten or missing information at the end of the interview.

Following the interview, participants were informed that the experimental portion of the study had ended, that their answers to the following questionnaire would not influence how their statement would be assessed, and that they should answer the next questions honestly. Participants then completed the Post-Interview questionnaire, where they were asked to rate several items on 5-point Likert scales (1 – strongly agree to 5 – strongly disagree): (i) The instructions clearly explained what I needed to do, (ii) I had enough time to prepare for the interview, (iii) I was motivated to convince the interviewer that I was innocent, (iv) I was successful in convincing the interviewer that I was innocent, (v) I prepared my statements strategically, (vi) The interviewer was friendly. Next, participants evaluated the truthfulness of both the critical and general components of their alibi using a 10-point scale (1 – not at all truthful to 10 – completely truthful). Finally, participants were debriefed, and the experiment was concluded. None of the participants were asked to stay longer and all participants were included in the raffle. Participation in the study took approximately 1 hour.

1.2.1 | Coding

Statements were assessed for the presence of spatial information (e.g., "Sitting in the row behind my friend"), temporal information (e.g., "It was 6:00 p.m."), and perceptual information (e.g., "I saw him sitting at the bar"; *richness of detail*), the *verifiability of detail* (e.g., a receipt of purchase), the presence of *complications* (e.g., missing the bus), *common knowledge details* (e.g., "We went to pick up groceries at the store"), and *self-handicapping strategies* (e.g., "I can't tell you

anything else because my friend did all of the planning"), and the clarity and plausibility of the statement (*statement quality*). The exact description of the verbal content coding can be found in the Supporting Information. Two scores were created for each dependent measure; the first was the sum of all occurrences in the entire statement, the second constituted the sum within the time period from 1:00 p.m. to 3:00 p.m. To establish reliability, the main coder and a second coder evaluated a randomly selected 20% of the statements. Using the two-way random effects model measuring consistency (see Koo & Li, 2016), interrater reliability was high for spatial information (Single Measures, Intraclass correlation coefficient, ICC = .79), temporal information (ICC = .93), and perceptual information (ICC = .78). The combined richness of detail variable thus had excellent reliability (ICC = .97), as did the verifiable details variable (ICC = .91). The reliability for coding the presence of complications, common knowledge details, and self-handicapping strategies was also adequate ($ICC's$ = .60, .51, and .71, respectively). The $ICC's$ were high for statement clarity (.90) and adequate for statement plausibility (.51), leading to a high reliability score for the combined statement quality variable (ICC = .87). After confirming the reliability between the two coders, the main coder completed the remaining sample of participants' statements. In the analyses, we used only the scores of the main coder.

1.3 | Deviations from preregistration

The analyses reported here deviate from the preregistration in several ways. All deviations were decided upon prior to analyzing the data. First, we preregistered two separate analyses, one based on "quantity of details" (e.g., particular information regarding places, times, persons, objects, and events) and one based on "the richness of detail". Instead, we limit our analysis to "richness of detail," a combination of all spatial, temporal, and perceptual information. Second, we preregistered predictions based on a measure combining the frequency of complications, self-handicapping strategies, and common-knowledge details. Instead, we coded the frequency of each cue separately and calculated the proportion of complications score (complications/ [complications + common knowledge details + self-handicapping strategies]). This is in line with previous literature (see, for example, Vrij, Leal, Jupe, & Harvey, 2018) and has theoretical advantages given that it is a within-subjects comparison that is also sensitive to the different verbal strategies used by liars and truth tellers. Finally, we specified a priori hypotheses regarding participants' self-reported strategies. We report these analyses in the Supporting Information to keep the manuscript within reasonable length.

2 | RESULTS

2.1 | Motivation, preparation, & self-perceived success

No significant differences between the three veracity conditions appeared for motivation, the clarity of instructions, preparation time, strategic preparation, and interviewer friendliness (see Supporting Information for exact analyses). Significant differences between the veracity conditions appeared for reported success in convincing the interviewer that they were innocent, $F(2, 108)$ = 4.74, p = .011, η_P^2 = .081. Truth tellers reported being the most successful (M = 4.14, SD = 0.82), followed by liars in the embedded lie condition (M = 3.78, SD = 0.82), and lastly liars in the complete lie condition (M = 3.51, SD = 0.96). Posthoc comparisons using the Bonferroni procedure indicated that the mean difference in self-perceived success was only statistically significant between the truth tellers and liars in the complete lie condition (p = .008).

2.2 | Truthfulness measures

We asked participants to rate, on a scale of one to ten (one being not at all truthful and ten being completely truthful) how truthful the 1:00 p.m. to 3:00 p.m. component of their alibi statement was. Significant differences emerged between the conditions, $F(2, 108)$ = 136.21, p < .001, η_P^2 = .716. Truth tellers reported that the critical component of their alibi was almost completely truthful (M = 9.59, SD = 0.90), whereas liars in the complete lie (M = 2.46, SD = 2.57) and embedded lie (M = 2.62, SD = 2.48) conditions indicated that only a small portion of their critical alibi component was truthful. Posthoc comparisons showed that the mean difference in reported truthfulness was statistically significant only between the truth tellers and liars in the complete lie condition (p < .001) and between the truth tellers and liars in the embedded lie condition (p < .001). Thus, the self-reported truthfulness of the critical component of interviewees' alibi statements conformed to the instructions they received across conditions.

Similarly, we asked participants to rate, on the same ten-point scale, how truthful their general alibi statement was, excluding the period from 1:00 p.m. to 3:00 p.m. Significant differences emerged between the conditions, $F(2, 108)$ = 75.82, p < .001, η_P^2 = .584. Truth tellers reported that the majority of their general alibi was truthful (M = 9.32, SD = 0.88). Liars in the complete lie condition reported that a portion of their general alibi was truthful (M = 3.32, SD = 2.76), whereas liars in the embedded lie condition reported that the majority of their general alibi was truthful (M = 7.92, SD = 2.45). Posthoc comparisons indicated that the mean difference in reported truthfulness was significant between truth tellers and liars in the embedded lie condition (p = .002), between truth tellers and liars in the complete lie condition (p < .001) and between liars in the embedded lie and liars in the complete lie conditions (p < .001). As above, the self-reported truthfulness of the general component of interviewees' alibi statements mostly corresponded to the instructions they received across conditions.

2.3 | Statement characteristics

Our primary analyses focused on examining the characteristics between entirely truthful statements versus entirely fabricated

statements, and between the deceptive 1:00 p.m. to 3:00 p.m. period embedded in lies and embedded in truths. Additionally, we conducted two exploratory analyses.[1] We compared the characteristics of the deceptive 1:00 p.m. to 3:00 p.m. period embedded in truths with the truthful 1:00 p.m. to 3:00 p.m. period also embedded into truths, and we compared the truthful parts of the statement flanking the deceptive 1:00 p.m. to 3:00 p.m. period to the truthful parts of the statement flanking the truthful 1:00 p.m. to 3:00 p.m. period.

2.3.1 | Confirmatory hypothesis testing

Statement characteristics were analyzed using a series of univariate between-subjects ANOVAs. 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 software. We report the Bayesian factors (BF; see Jarosz & Wiley, 2014; 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, between 3 and 10 indicate substantial evidence, between 10 and 20 constitutes strong or very strong evidence, and scores above 20 are considered very strong or decisive evidence. For ease of interpretation, BF_{10} indicates the Bayes factor as evidence in favor of the alternative hypothesis, whereas BF_{01} indicates the Bayes factor as evidence in favor of the null hypothesis.

2.3.2 | Richness of detail

We first compared the completely truthful to the completely fabricated statements on the richness of details (i.e., amount of spatial, temporal, and perceptual information combined) by conducting a univariate between-subjects ANOVA. As predicted, truthful statements ($M = 56.46$, $SD = 27.85$) scored higher on richness of details than fabricated statements ($M = 41.38$, $SD = 15.66$), $F(1, 72) = 8.24$, $p = .005$, $\eta_P^2 = .103$, $BF_{10} = 7.51$, lending support to Hypothesis 1.

Next, we tested Hypothesis 2 by conducting a second univariate between-subjects ANOVA to compare the detail richness of the 1:00 p.m. to 3:00 p.m. period between the embedded lie and complete lie conditions. We did not observe a significant effect for the richness of detail, $F(1, 72) = .21$, $p = .648$, $\eta_P^2 = .003$, $BF_{01} = 3.80$, meaning that lies embedded into otherwise truthful statements were not significantly richer in detail than lies embedded into entirely fabricated statements. As such, we did not find support for Hypothesis 2.

2.3.3 | Secondary content cues

To evaluate Hypothesis 3, we conducted a series of univariate between-subjects ANOVAs to compare the completely truthful to the completely fabricated statements on (a) the amount of verifiable details, (b) the number of complications, common knowledge details,

and self-handicapping strategies, (c) the total proportion of complications (i.e., complications/[complications + common knowledge details + self-handicapping strategies]), and (d) the quality of statements (i.e., the clarity/plausibility). Truthful statements ($M = .30$, $SD = .62$) contained significantly fewer self-handicapping strategies than fabricated statements ($M = .65$, $SD = .86$), $F(1, 72) = 4.09$, $p = .047$, $\eta_P^2 = .054$, but the BF_{10} of 1.34 was not very diagnostic. We did not observe significant effects of Veracity on the remaining dependent variables: The amount of verifiable details, $F(1, 72) = 1.76$, $p = .189$, $\eta_P^2 = .024$, $BF_{01} = 1.96$; the number of complications, $F(1, 72) = 1.54$ $p = .219$, $\eta_P^2 = .021$, $BF_{01} = 2.15$; the number of common knowledge details, $F(1, 72) = 2.88$, $p = .094$, $\eta_P^2 = .038$, $BF_{01} = 1.22$; the proportion of complications, $F(1, 72) = 2.65$, $p = .108$, $\eta_P^2 = .036$, $BF_{01} = 1.34$; the quality of statements, $F(1, 72) = .70$, $p = .407$, $\eta_P^2 = .010$, $BF_{01} = 3.08$. The exact values can be found in Table 2. Hence, we received only partial support for Hypothesis 3, that completely truthful statements would contain more high-quality content cues compared to fabricated accounts.

We tested Hypothesis 4 by conducting a second series of univariate between-subjects ANOVAs to compare the 1:00 p.m. to 3:00 p.m. period between the Embedded lie and Complete lie conditions on the same secondary content cues. Only one significant difference emerged: Liars in the complete lie condition provided some self-handicapping strategies ($M = .11$, $SD = .32$) during the critical portion of the alibi, whereas those in the embedded lie condition did not provide any, $F(1, 72) = 4.36$, $p = .040$, $\eta_P^2 = .057$, $BF_{10} = 1.53$. We did not observe a significant effect for the remaining variables: The amount of verifiable details, $F(1, 72) = 1.26$, $p = .265$, $\eta_P^2 = .017$, $BF_{01} = 2.42$; the number of complications, $F(1, 72) = 1.13$, $p = .292$, $\eta_P^2 = .015$, $BF_{01} = 2.57$; the number of common knowledge details, $F(1, 72) = 3.22$, $p = .077$, $\eta_P^2 = .043$, $BF_{01} = 1.05$; the proportion of complications, $F(1, 72) = 0.77$, $p = .382$, $\eta_P^2 = .011$, $BF_{01} = 2.98$; the quality of statements, $F(1, 72) = .17$, $p = .685$, $\eta_P^2 = .002$, $BF_{01} = 3.88$. See Table 2 for the exact values. Thus, our analysis of the secondary content cues revealed no differences between lies embedded in truths and lies embedded in lies, with Bayes Factors demonstrating weak to substantial evidence in favor of the null hypothesis. The only exception was self-handicapping strategies.

2.3.4 | Exploratory testing

Having found that lies embedded in otherwise truthful statements did not differ from lies embedded in an otherwise deceptive statement, we were also interested to what extent these embedded lies could be distinguished from truths. We therefore conducted an exploratory analysis of the 1:00 p.m. to 3:00 p.m. period between the embedded lie condition (lie embedded into a truthful statement) and the truth teller condition (truth also embedded into a truthful statement). The embedded truths ($M = 21.22$, $SD = 12.33$) were significantly richer in detail than the embedded lies ($M = 15.22$, $SD = 9.65$), $F(1, 72) = 5.43$, $p = .023$, $\eta_P^2 = .070$, $BF_{10} = 2.39$. Embedded truths ($M = 2.95$, $SD = 1.10$) were also rated as having higher statement quality than

TABLE 2 Exact values of dependent measure scores in the critical and general statement components as a function of veracity condition

Dependent variable	Veracity condition	Statement component	Mean value	Confidence intervals (95% CI)
Richness of detail*+	Truth teller*+	1:00–3:00 p.m.*	21.22	[17.10, 25.33]
		General statement+	56.46	[47.17, 65.75]
	Embedded liar*	1:00–3:00 p.m.*	15.22	[12.00, 18.43]
		General statement	51.68	[43.68, 59.67]
	Complete liar+	1:00–3:00 p.m.	14.24	[11.39, 17.09]
		General statement+	41.38	[36.16, 46.60]
Verifiability of details	Truth teller	1:00–3:00 p.m.	3.14	[2.29, 3.98]
		General statement	9.57	[7.75, 11.38]
	Embedded liar	1:00–3:00 p.m.	2.14	[1.51, 2.76]
		General statement	8.14	[6.68, 9.60]
	Complete liar	1:00–3:00 p.m.	2.70	[1.89, 3.52]
		General statement	8.00	[6.43, 9.57]
Complications	Truth teller	1:00–3:00 p.m.	0.22	[0.04, 0.39]
		General statement	0.89	[0.41, 1.37]
	Embedded liar	1:00–3:00 p.m.	0.16	[0.04, 0.29]
		General statement	1.08	[0.26, 1.90]
	Complete liar	1:00–3:00 p.m.	0.08	[−0.01, 0.17]
		General statement	0.54	[0.23, 0.85]
Common knowledge details	Truth teller	1:00–3:00 p.m.	1.41	[0.95, 1.86]
		General statement	6.14	[4.91, 7.36]
	Embedded liar	1:00–3:00 p.m.	2.00	[1.49, 2.51]
		General statement	7.76	[6.37, 9.14]
	Complete liar	1:00–3:00 p.m.	1.43	[1.04, 1.82]
		General statement	7.57	[6.37, 8.77]
Self-handicapping strategies+	Truth teller+	1:00–3:00 p.m.	0.05	[−0.02, 0.13]
		General statement+	0.30	[0.09, 0.50]
	Embedded liar	1:00–3:00 p.m.	0.00	[0.00, 0.00]
		General statement	0.43	[0.22, 0.65]
	Complete liar+	1:00–3:00 p.m.	0.11	[0.00, 0.21]
		General statement+	0.65	[0.36, 0.93]
Proportion of complications	Truth teller	1:00–3:00 p.m.	0.13	[0.02, 0.23]
		General statement	0.15	[0.06, 0.24]
	Embedded liar	1:00–3:00 p.m.	0.07	[0.00, 0.13]
		General statement	0.13	[0.04, 0.21]
	Complete liar	1:00–3:00 p.m.	0.03	[−0.01, 0.07]
		General statement	0.07	[0.02, 0.11]
Statement quality*	Truth teller*	1:00–3:00 p.m.*	2.95	[2.58, 3.31]
		General statement	2.73	[2.37, 3.09]
	Embedded liar*	1:00–3:00 p.m.*	2.35	[1.93, 2.77]
		General statement	2.35	[2.00, 2.70]
	Complete liar	1:00–3:00 p.m.	2.46	[2.12, 2.80]
		General statement	2.54	[2.25, 2.83]

Note: The asterisks (*) indicate the dependent variables with statistically significant differences for the 1:00 to 3:00 p.m. critical component and where these differences occurred. The plus signs (+) indicate the dependent variables with statistically significant differences for the general component and where these differences occurred.

embedded lies (M = 2.35, SD = 1.25), $F(1, 72)$ = 4.69, p = .034, η_P^2 = .061, BF_{10} = 1.76. We did not find significant differences for the remaining variables: The amount of verifiable details, $F(1, 72)$ = 3.74, p = .057, η_P^2 = .049, BF_{01} = 0.85; the number of complications, $F(1, 72)$ = 0.25, p = .616, η_P^2 = .004, BF_{01} = 3.73; the number of common knowledge details, $F(1, 72)$ = 3.12, p = .082, η_P^2 = .042, BF_{01} = 1.10; the number of self-handicapping strategies, $F(1, 72)$ = 2.06, p = .156, η_P^2 = .028, BF_{01} = 1.72; the total proportion of complications, $F(1, 72)$ = 1.00, p = .321, η_P^2 = .014, BF_{01} = 2.71. Exact values can be found in Table 2. These results indicate that lies embedded into otherwise truthful accounts can be differentiated from truths based on detail richness and statement quality, although the Bayes factors indicate the evidence for this is weak at best.

We preregistered our hypothesis that lies embedded in truths would be richer in detail than lies incorporated into fully fabricated accounts. It is, however, also possible that embedded lies affected the flanking truthful component. To investigate this, we conducted a series of independent samples t-tests on the dependent measures between the truthful portions flanking the embedded lies, and the same components flanking the truths. Embedded liars (M = 36.46, SD = 17.91) and truth tellers (M = 35.24, SD = 20.74) provided similar richness of detail in the truthful components of their statements, $t(72)$ = −.27, p = .788, d = −.06, BF_{01} = 4.03. Similarly, we did not find significant differences for the remaining variables: The amount of verifiable details, $t(72)$ = .34, p = .735, d = .08, BF_{01} = 3.96; the number of complications, $t(72)$ = −.47, p = .639, d = −.11, BF_{01} = 3.78; the number of self-handicapping strategies, $t(72)$ = −1.15, p = .253, d = −.27, BF_{01} = 2.35; the number of common knowledge details, $t(72)$ = −1.40, p = .165, d = −.33, BF_{01} = 1.79. These results indicate that the truthful components of statements were consistently rich in detail and included similar quality of detail, regardless of whether the statement was entirely truthful or contained an embedded lie.

3 | DISCUSSION

In line with previous research (e.g., Amado et al., 2016; Luke, 2019), we found that entirely truthful statements were richer in detail compared to entirely fabricated statements (Hypothesis 1). In contrast to previous findings by Verigin et al. (2019), we did not find evidence that lies embedded into truthful stories were more richly detailed than lies embedded into completely fabricated stories (Hypothesis 2). Regarding our secondary dependent measures, self-handicapping strategies emerged as the only (weakly) diagnostic cue to differentiate entirely truthful statements from entirely fabricated statements (Hypothesis 3), and embedded lies from complete lies (Hypothesis 4).

This experiment investigated how the verbal content of lies was affected by embedding them into otherwise truthful statements. Our hypotheses, that lies embedded in truthful information would be richer in details (Hypothesis 2) and other high-quality details (Hypothesis 4) than lies that are part of completely fabricated statements, were not supported. Consequently, lies embedded in otherwise truthful statements and lies embedded in deceptive statements could be distinguished from truths equally well. Our finding that lies embedded in truthful statements can be differentiated from truths that are part of fully truthful accounts is comparable to that of Gnisci, Caso, and Vrij (2010). It is encouraging that in both studies, even when liars incorporate truthful, previously experienced information into their fabrications, differences still exist between these deceptive and truthful elements. This has important implications for practice, as it means that tools used in in the field such as Criteria-Based Content Analysis (CBCA; Steller & Köhnken, 1989) may be robust to the influence of embedded lies.

Compared to being entirely truthful or entirely deceptive, telling a mixture of truths and lies could have resulted in reporting more details about the deceptive parts of their statement, fewer details about the truthful parts of their statement, or a combination of both. The lack of difference between the two types of lies suggests that embedded liars did not maintain consistency between the truthful and fabricated components of their statements. A potential explanation could be that, without specific knowledge of the criteria indicative of truthfulness, it would be difficult for liars to produce a fabricated element that is comparable in detail and quality to the truthful component. The only observable difference between the two types of lies was with regard to the presence of self-handicapping strategies; however, the observed significance can be explained by a floor effect meaning this result should be interpreted with caution. Additionally, we found that interviewees provided similar richness and quality of detail in the truthful components of their accounts, regardless of whether this component was flanked by truthful or deceptive information. This provides interesting insight into the high quality of statements that could potentially be provided by embedded liars.

When comparing the entire statement, completely truthful accounts differed from fully fabricated accounts, though only with regard to our primary cue richness of detail (Hypothesis 1) and self-handicapping strategies (Hypothesis 3). Importantly, richness of detail is the most empirically supported cue from the literature and therefore contributes strong insights to our pattern of results. Regarding our secondary cues, we failed to replicate previous findings that truthful accounts contain more verifiable details than deceptive ones. A potential explanation for the discrepancy between our findings and the general verifiability literature is that we did not employ the entire VA procedure (see also Bogaard, Meijer, & Van der Plas, 2019; Nahari et al., 2014b). Research suggests that the VA approach is most effective when, prior to their interview, interviewees are requested to include details that the investigator can check—what is known as the information protocol (Harvey et al., 2016; Nahari et al., 2014b). We opted not to use this protocol because this instruction may have affected liars' and truth tellers' responses and influenced the other dependent measures of our experiment.

We also did not find the proportion of complications to be a diagnostic cue to veracity in any of the three comparisons. This may have been due to floor effects in our sample (truthful interviewees in our study reported on average, less than one complication, relative to other studies in which truthful reports typically produce an average of

ten or more complications; e.g., Vrij, Leal, Jupe, & Harvey, 2018; Vrij, Leal, Mann, et al., 2018). Regarding common knowledge details, it has been suggested that truthful interviewees sound scripted in their reports if they underestimate the amount and type of detailed information they are required to report (Vrij, 2018). A potential reason for not observing significant differences with regard to the proportion of complications was due to the reduced time period, as well as the events, that participants were reporting in their alibi statement. If participants had reported longer, more dynamic statements, perhaps after exposure to a model statement (e.g., Leal et al., 2015), then the proportion of complications may have been a more effective cue.

We also did not observe differences regarding the statement quality between completely truthful statements and completely fabricated statements when comparing the entire accounts, yet we did replicate this effect when comparing only the embedded 1:00 p.m. to 3:00 p.m. component of the alibis. Reporting truthfully involves retrieving and reconstructing one's memory, whereas constructing a lie involves fabricating a story based on scripted knowledge about comparable situations and events (Schank & Abelson, 1977). Considering that liars in our study admitted having included some truthful information in their statements, it is possible that this allowed their overall statements to come across equally as clear and plausible as honest interviewees.

3.1 | Limitations and future research

The goal of our study was to examine embedded lies and we did so by isolating a critical statement of interest, while manipulating the veracity of the surrounding components. However, the period for which the liars came up with spanned 2 hours. In real life, liars may stay as close to the truth as possible, only fabricating or omitting a few key, incriminating details. Future research could extend our paradigm to accommodate for the dispersion of truths and lies throughout a statement and particularly how interviewees' verbal content may be inconsistent when they lie and tell the truth in a single account.

A second limitation is that the self-reported truthfulness ratings revealed that liars instructed to fabricate their entire account reported still including some truthful information, and the embedded liars reported that their general statement was mostly truthful, but still included some lies. This may be methodologically somewhat awkward but it does reflect what liars typically do: Providing statements that contain a mixture of truths and lies (Leins et al., 2013; Leins, Zimmerman, & Polander, 2017). As such, the finding is high in ecological validity. We did, however, check by self-report that liars did not engage in the assigned activity on the day in question nor on any adjacent days. This does not, of course, exclude the possibility that they engaged in the activity on an earlier occasion, meaning they could still have drawn from this truthful experience, simply displacing it in time. Future research that manipulates the type of lie that interviewees provide, such that it

cannot be readily drawn from a potential previous experience, may produce a different pattern of results. Another methodological adjustment that may yield different findings would be allowing participants to choose the topic of their report, rather than constraining their reports to an activity scripted by the experimenter. This would more appropriately reflect the circumstances of real-world liars, who are typically not forced to report any particular event (e.g., Leins et al., 2013).

Another important consideration relates to ground truth. Our study involved interviewees reporting self-generated stories within a naturalistic alibi scenario. We established partial ground truth via our truthfulness measures, which indicated that participants largely conformed to the experimental instructions. We were unable to further corroborate participants' accounts, however. Although the current experiment ensured that participants were emotionally engaged with the experimental process and similar paradigms have been used extensively by deception researchers (e.g., Elntib, Wagstaff, & Wheatcroft, 2015; Masip et al., 2005; Sporer & Sharman, 2006), future research would benefit from attempting to establish ground truth. A possible way to do so without having to resort to artificial mock crime procedures would be to require participants to wear a video-recording device for a certain duration of hours over a period of several days. Then, the researcher could verify the veracity of the interviewees' reports in the subsequent interview (e.g., Meixner & Rosenfeld, 2014).

3.2 | Conclusion

In sum, we showed that truthful statements could be distinguished from fabricated ones, and that lies embedded in otherwise truthful statements did not differ from lies embedded in deceptive statements. We also showed that lies embedded in otherwise truthful statements could be distinguished from truths embedded in truthful statements. Accordingly, verbal credibility assessment tools based on verbal content measured in this study may be robust against the embedding of lies.

CONFLICT OF INTERESTS
The authors declare no potential conflict of interest.

ENDNOTE
[1] An alternative analysis would be to run within-participant analyses to compare truth – lie differences. Such analyses are methodologically inappropriate as these comparisons potentially confound truth lie differences with duration and activity; specifically, the critical period spanned two hours, whereas a morning and evening can describe a more variable period, and will likely describe different activities.

DATA AVAILABILITY STATEMENT

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