

ARTICLE

The language of high-stakes truths and lies: Linguistic analysis of true and deceptive statements made during sexual homicide interrogations

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Abstract

Purpose: Few studies have assessed deception during real-life, high-stakes encounters. This study is one of the largest and most geographically diverse to investigate how criminal suspects lie during investigative interviews. It is also one of the most specific; focusing solely on those who committed sexually motivated homicides.

Methods: Sections of transcripts from 52 sexually motivated homicide offender interrogations were analysed using Linguistic Inquiry and Word Count software. Truthful ($n = 27$) and deceptive ($n = 25$) statements, corroborated through physical evidence, were then compared using the reality monitoring (RM) model of deception.

Results: Support for the RM model was mixed. Truthful statements contained more motion and spatial details. There were no significant differences between true and deceptive statements when comparing perceptual, affective, and cognitive process details.

Conclusions: The results support the notion that there are verbal cues to deception detectable in high-stakes, real-life situations. It also provides a starting point to assess these cues in special forensic populations.

KEYWORDS

automated deception detection, high-stake lies, interrogation, reality monitoring

BACKGROUND

Despite being the subject of fascination for millennia (Trovillo, 1939), few studies have assessed deception during real-life, high-stakes encounters. This study is one of the largest and most geographically diverse to investigate how criminal suspects lie during investigative interviews. It is also the most specific; focusing on those who committed sexually motivated homicides. Utilizing linguistic analysis software, the reality monitoring (RM) model of deception will be tested using this unique sample.

One of the most reliable findings on deception is that our ability to discern lies from truths rarely exceeds chance levels (Bond & DePaulo, 2006; Vrij, 2019). Even those considered professional lie detectors show no distinct advantage over laypeople in this skill (Bond & DePaulo, 2006). This may be due to the fact that lying is not a unique psychological process with correspondingly distinct behaviours, while liars and truth-tellers have the same general goal: to appear honest (DePaulo & Morris, 2004). It may also be due to a reliance on cues that have little diagnostic value (Hartwig & Bond, 2011; Hudson et al., 2020; Leach et al., 2020; Vrij, 2008). These cues have been further codified into tactics developed by practitioners such as the Reid Technique (Reid & Buckley, 2011), one of the most frequently taught in the United States (Vrij et al., 2006). However, the non-verbal cues that make up the bulk of this training are unreliable indicators of deception (DePaulo et al., 2003).

In parallel to the development of techniques by practitioners, the deception research literature has grown rapidly over the last 55 years (Granhag & Strömwall, 2004; Masip, 2017; Vrij et al., 2019). While many techniques have been proposed, they can be generally identified as belonging to one of three approaches: the analysis of verbal content, the analysis of non-verbal cues, and analysis of psychophysiological responses (DePaulo & Morris, 2004). Of these approaches, verbal cues appear to be more diagnostic of deception (DePaulo et al., 2003; Porter & Yuille, 1996; Vrij, 2008). This study focuses on RM, among the most well studied and validated verbal deception detection models (Sporer et al., 2021).

The central concept of RM is that memories of actual events will differ in discernible ways from fabricated or imagined events (Johnson & Raye, 1981). It is a favoured model of researchers due to its strong theoretical and empirical foundations (Sporer, 2004; Vrij, 2008). Memories contain four types of information: contextual (space and time relationships), sensory/perceptual, semantic, and cognitive operations (Johnson & Raye, 1981). Real events are experienced through sensory information and organized in the relationships of objects/people to one another (Johnson & Raye, 1981; Sporer, 2004). On the other hand, imagined events do not have the benefit of these sensory and contextual inputs. As a result, they are more likely to contain cognitive operations and will be vaguer than an actual experienced event (Johnson & Raye, 1981). RM has shown promising, if at times inconsistent, results in differentiating truths from lies, with overall accuracy ranging from 65% to 85% (Masip et al., 2005). These results are comparable to Criteria-Based Content Analysis (Masip et al., 2005), and exceed average human judgements (Vrij, 2019). A recent meta-analysis showed that the total RM score discriminated between true and imagined events with $d = 0.54$ (Gancedo et al., 2021). The meta-analysis by Hauch et al. (2015) included two research questions with direct bearing on RM: they predicted that lies would include fewer sensory and contextual details, and they investigated the role of cognitive operations, with the expectation that lies would contain fewer cognitive operation, as per original RM theory. They found a small effect for sensory and perceptual details, but no support for the notion that lies are less contextually embedded. They did find that lies contained fewer cognitive operations, defined by words related to inner states or mental processes. Another meta-analysis by Oberlader et al. (2016) found strong support for content-based models in general, including for RM (for another recent review on RM in political debates, see Bond et al., 2019). The accumulated literature, in line with the qualitative review by Vrij (2008), thus shows some support for RM in discriminating between truthful and deceptive statements. RM's criteria have the further advantage of being assessable through the use of automated linguistic software, such as Linguistic Inquiry and Word Count (LIWC; Bond & Lee, 2005).

Linguistic inquiry and word count

One of the most widely utilized automated linguistic analysis systems studied by deception researchers (Matsumoto & Hwang, 2015) is the LIWC software developed by Pennebaker et al. (2001). LIWC has been applied across a wide range of psychological research, and has shown promise in distinguishing a person's emotionality, personality, and cognitive processes (Tausczik & Pennebaker, 2010). It has also been used to study deception. LIWC categorizes words into various standard language components (e.g. verbs and prepositions), psychological processes (e.g. positive emotions), sensory information (e.g. tactile details), contextual relationships (e.g. spatial details), and personal concerns (e.g. relationship words). The LIWC dictionary contains approximately 2300 words and captures approximately 80% of all spoken and written words (Pennebaker & Graybeal, 2001).

The software has been used in a variety of deception studies, with promising results (Bond & Lee, 2005; Hauch et al., 2015; Newman et al., 2003), including findings that suggest the bottom-up processing of LIWC (Bond & Lee, 2005) may make it tolerant to cultural and ethnic variations in speech (Matsumoto & Hwang, 2015). Research utilizing linguistic software has generally supported theoretical assumptions regarding the verbal behaviour of deceivers. A meta-analysis of automated deception detection (Hauch et al., 2015) literature found that lies were shorter, less elaborate, and complex than true statements, but contained more negative words.

External validity

Despite the promising results various techniques and automated systems have provided, one of the recurring criticisms of the deception literature, in general, is a dearth of high-stakes, externally valid samples (Porter & ten Brinke, 2010; Vrij, 2014; Vrij et al., 2010). The majority of the literature has used students as participants (Bond & DePaulo, 2006; Hauch et al., 2015), and these lies may not trigger the same type and/or intensity of behaviours that occur in a highly urgent situation, such as the interrogation of a suspect in relation to a serious crime (Cooper et al., 2009; Vrij, 2008). Young, Caucasian university students, who make up most of the samples used in the literature (DePaulo et al., 2003; Hauch et al., 2015), are not representative of the typical criminal suspect subjected to interrogation (FBI, 2012). The demographics of the sample used in this study resemble those of typical violent criminal suspects much more closely. The consequences of not being believed may also affect how honest individuals behave during critical questions. Liars in most laboratory studies are asked to create a fictitious account, and if caught will face negligible consequences (Cooper et al., 2009). Research has found mixed results regarding the role motivation plays in deception detection. Meta-analyses conducted by Bond and DePaulo (2006) found some support for the notion that deception detection accuracy was greater when the sender was more motivated, while Hartwig and Bond (2014) found accuracy rates remained stable across more and less externally valid studies.

Criminals may also lie in significantly different ways (Leins et al., 2013). While participants typically report a specific event under the instruction of researchers, real-world deceivers are not restricted in what they can report (Leins et al., 2013; Vrij, 2008). When given this opportunity 86% of participants chose to recall a previously experienced event rather than create an outright fabrication (Leins et al., 2013). These strategies may impede content-based deception detection techniques such as RM (Vrij et al., 2010). Criminals may also have distinct strategies in deceiving others (Granhag et al., 2009), more knowledge and experience in lying, and consider lying to require less cognitive resources (Granhag et al., 2004; Porter, Doucette, et al., 2008; Porter, England et al., 2008). Lies and true statements made by prisoners differed in unique ways that have been found in laboratory-based studies (Bond & Lee, 2005).

One of the major issues in conducting deception studies using 'real-world' samples is the difficulty in establishing ground truth (Vrij et al., 2010). The largest field study to date (Fuller et al., 2011) examined the written statements of 367 persons of interest in various crimes that occurred on several US military bases over a 4-year period. The authors established ground truth through the suspect's own

admission, a charge of ‘making a false official statement’ filed against the suspect, physical evidence, or an eyewitness. Not all these criteria establish absolute ground truth. Other researchers (McQuaid et al., 2015) have used linguistic software to analyse statements made by individuals pleading for the safe return of their missing loved ones, half of which were later determined to be the murderer.

Vrij, Mann, and colleagues are the only researchers to have attempted to measure behaviours of criminal suspects lying and telling the truth inside the interrogation room. Vrij and Mann (2001) analysed the video of a murderer first during a false statement, and later during a confession. When lying the suspect made more and longer pauses, more speech errors, and showed some behavioural inhibition. A follow-up study (Mann et al., 2002) analysed the videotaped interrogations of 16 suspects, who were being investigated for crimes ranging from theft to murder. The authors used a within-subjects design and found that suspects paused for longer, blinked less, and made fewer hand and finger movements when lying. These behaviours are considered indirect measures of cognitive demand (Smith & Clark, 1993; Spence et al., 2004). However, both studies collected their sample from a single police agency in the United Kingdom. The study by Mann et al. (2002) included both minors and adults and did not measure the verbal content of the statements other than total words spoken.

All these field studies treat criminal suspects as a single population. In addition to there being a significant difference in stakes between being accused of theft and murder, the types of individuals that commit these crimes may be quite different (Canter, 1994). Within the crime of murder, those who kill in response to an argument may be vastly different than those who kill for instrumental or sexual gain (Salfati & Canter, 1999; Schlesinger, 2004). Offenders who engaged in instrumental violence scored higher on the Psychopathy Checklist-Revised (PCL-R) than non-instrumental offenders (Woodworth & Porter, 2002). Given this, it may be necessary to assess the behaviours associated with deception for specific classes of criminal suspects. Instrumental offenders, such as sexually motivated murderers, may deploy tactics that differ from other types of offenders in attempts to deceive investigators. Given both the attention and horror ascribed to these crimes by the public and the increased risk such murderers may seek out further victims (Schlesinger, 2004), being able to understand the tactics these offenders deploy is of utmost importance and necessitates more nuanced deception research.

Present study

This study expands upon the handful of high-stakes studies that currently exist in the deception literature and provides one of the largest samples to date of verbal cues measured during real-life interrogations. Utilizing LIWC 2007 software, verbatim transcripts of 52 sexual homicide interrogations were analysed. This sample represents the most geographically diverse in the literature, with individual cases from across the United States. At the same time, it is the most crime specific, exclusively comparing a population of convicted, sexually motivated murderers. To the best of our knowledge, this is one of the first studies to analyse this subtype of the offender under real-world conditions and exclusively focus on verbal cues.

In line with the RM theory (Johnson & Raye, 1981), deceptive statements are expected to produce fewer sensory/perceptual (LIWC categories *see*, *hear*, and *feel*), contextual (LIWC categories *motion*, *space*, and *time*), and affective details (LIWC category *affect*), while reporting more cognitive processes (LIWC category *cogmech*).

METHOD

Data

A non-random sample of 52 sexually motivated homicide offenders from multiple jurisdictions across the United States was examined. Only one file was selected from any given jurisdiction. The data for this

research were taken from closed, fully adjudicated state and local cases that were contributed by law enforcement agencies from around the country for the purpose of research. All identifiers, including names of victims, suspects, offenders, officers, departments, and correctional agencies, were removed. Only aggregate data are reported. All offenders in the study either pled guilty or were convicted at trial of the attributed homicides. There were no known cases of a wrongful conviction, false confession, or successful appeal. The entire case file for each offender was examined which included police, medical examiner, autopsy, and hospital reports, statements of witnesses and offenders, crime scene photos, maps, scientific and technical reports, geographic and offender profile reports, and mental health evaluations. Homicides were determined to be sexually motivated if one of three conditions were met: the offender engaged in any form of sexual contact with the victim immediately prior to, or during, the murder, or engaged in any necrophilic acts with the victim's body (1), the offender engaged in any genital mutilation (2), or the offender stated during the interrogation that his goal was to sexually assault the victim (3).

Of the 52 offenders included in the study all were male and were an average age of 26.73 years old ($SD = 8.01$, $range = 18-56$) at the time of the interrogation. The majority of the sample ($n = 32$, 61.5%) were Caucasian, while 30.8% ($n = 16$) were African American, 3.8% ($n = 2$) were Hispanic, 1.9% ($n = 1$) was Asian, and 1.9% ($n = 1$) was Aboriginal. Most of the offenders studied ($n = 34$, 65.4%) had been previously convicted of a criminal offense. Most offenders in the sample were responsible for the murder of a single victim ($n = 34$, 65.4%), however, the number of victims the offender murdered ranged from 1 to 7 ($M = 1.69$, $SD = 1.26$). During the sample selection, any offenders who appeared to be intoxicated or suffering from a mental illness at the time of the interrogation were excluded from the study, as were any offenders under the age of 18.

Procedure

Relevant sections of verbatim interrogation transcripts present in the case files were selected for analysis based on the availability of unambiguous ground truth. Ground truth was established by comparing the statement to physical and/or demonstrative evidence contained in the remainder of the file, which, due to security restrictions on the data, was reviewed by the first author. To be included in the study the offender's statement was corroborated or disproved through at least one piece of physical, demonstrative (e.g. video surveillance and phone logs), and/or DNA evidence related directly to the excerpt being studied. In the majority of cases, ground truth was established through multiple forms of evidence. In the case of one deceptive statement, the offender denied having ever encountered the victim and gave an account of having spent the night working on his property, alone. His DNA was matched to semen found inside the victim during the autopsy, and his fingerprints were found inside the victim's abandoned vehicle. A truthful statement from another offender regarding his disposal of evidence was confirmed via video surveillance.

The sample contained 27 instances of truthful statements (51.9%) and 25 instances of deceptive statements (48.1%). Only one statement per offender was selected. Statements were selected from the available dataset by the first author, first by reviewing the interrogation transcript for a suitable excerpt (i.e. sufficient length, verifiable details, and containing critical details) primarily composed of an offender responding in detail to open-ended questions and providing details to substantive follow-up questions. Physical evidence in the case file was then reviewed to establish ground truth to assign the excerpt to truthful or deceptive conditions. In all cases the selected segments of the offender's statement were concerned with critical details surrounding the crime (e.g., pre- or post-crime details), but not how the actual murder was carried out. This decision was made to better control for any differences in memory or social interaction that may occur during a confession of the crime itself, therefore making the truthful and deceptive sample statement contexts as similar as possible. Both the truthful and deceptive sample statements consisted of the offenders providing detailed accounts of the movements and activities in a mostly uninterrupted narrative.

Once the transcript segments had been selected the offender's contribution to the conversation was typed into a word processor document per the instructions in the LIWC manual. Punctuation and

capitalization were removed, and each statement was prepared as a single segment to be analysed. Non-fluencies and filler speech errors were transcribed in accordance with the LIWC manual (Pennebaker et al., 2001). These selections were then analysed by the LIWC software using the 2007 version of the English dictionary provided. The LIWC software outputs word counts in each category as a percentage of the total word count of the statement (with the exception of the word count variable, which provides a raw score). The LIWC categories relevant to the hypotheses of this study were then compared using student's *t*-tests.

RESULTS

Preliminary analyses

There were no significant differences between truthful and deceptive statements on any demographic variables. Offenders in the deceptive ($M = 28.48$, $SD = 8.57$) and truthful ($M = 25.11$, $SD = 7.20$) conditions did not differ in age, $t(50) = -1.54$, $p = .13$, $d = 0.43$, number of victims (liars: $M = 1.44$, $SD = 0.77$; truth tellers: $M = 1.93$, $SD = 1.57$), $t(38.44) = 1.44$, $p = .16$, $d = 0.40$, ethnicity, $\chi^2(3, N = 52) = 2.30$, $p = .51$, Cramér's $V = .21$, or the presence of a criminal history (liars: 68%; truth tellers: 63%), $\chi^2(1, N = 52) = 0.146$, $p = .70$, Cramér's $V = .05$. There was also no significant difference in the total word count of truthful ($M = 488.04$, $SD = 244.52$) and deceptive ($M = 409.44$, $SD = 155.03$) statements, $t(50) = -1.40$, $p = .17$, $d = 0.38$. To mitigate the risk of Type I error associated with repeated testing, a Bonferroni correction was used to set $\alpha = .006$.

Hypothesis testing

The results provided mixed support for the RM model (see Table 1). There were no significant differences in the reporting of visual and auditory details. Although truthful statements had more tactile details, $t(50) = 2.04$, $p = .05$, $d = 0.57$, this was not significant at the corrected α . Details related to relativity between objects were more discriminating. Truthful statements reported more spatial, $t(50) = 5.55$, $p < .001$, $d = 1.54$, and motion $t(50) = 3.44$, $p = .001$, $d = 0.96$, details. There were no significant differences between the two groups in the reporting of cognitive processes, temporal details, or affect.

DISCUSSION

The current study utilized LIWC software (Pennebaker et al., 2001) to assess the word usage of a sample of sexually motivated homicide offenders during their police interrogations. This is one of the largest

TABLE 1 Do liars report fewer details than truth-tellers?

LIWC category	Example	Truth-tellers, <i>M</i> (<i>SD</i>)	Liars, <i>M</i> (<i>SD</i>)	<i>p</i>	<i>d</i>
Visual details	<i>Saw, seen</i>	0.91 (0.64)	0.79 (0.55)	.49	0.20
Auditory details	<i>Listen, hearing</i>	0.81 (0.99)	1.19 (0.85)	.15	0.41
Tactile details	<i>Feels, touch</i>	0.56 (0.43)	0.33 (0.39)	.05	0.56
Temporal details	<i>End, until</i>	4.75 (1.72)	5.40 (1.82)	.19	0.37
Spatial details	<i>Down, in</i>	11.43 (2.23)	8.33 (1.76)	<.0001	1.54
Motion details	<i>Arrive, go</i>	5.59 (1.73)	4.11 (1.34)	.001	0.96
Affective	<i>Love, hate</i>	1.70 (1.02)	2.21 (1.36)	.13	0.42
Cognitive processes	<i>Think, know</i>	16.36 (4.04)	17.15 (2.96)	.43	0.22

studies to date measuring verbal cues during real-life interrogations and, to the best of our knowledge, the first to exclusively study sexual homicide offenders, a population that may be particularly skilled at deception as well as at heightened risk to reoffend (Schlesinger, 2004). It also contributes to the relatively small number of studies that have assessed high-stakes lies, particularly in a police interrogation context.

One of the main challenges using real-world interrogation sources in deception research is the establishment of ground truth. The current study benefits from having complete law enforcement case files, including technical and laboratory reports, allowing it to reliably classify statements as either deceptive or truthful through physical and demonstrative evidence. Another concern is ensuring that truthful and deceptive statements are equivalent in content and context. Confessing the intimate details of murder may cause both the offender and interviewer to feel a wide range of emotions, and in turn, impact their language use. The present study attempts to limit these differences by choosing excerpts that contain substantive, minimally interrupted, narratives by the offender about relevant details concerning events just before the homicide itself or actions taken afterwards. Offenders making both deceptive and honest statements have the same goal: to appear honest and be believed. By focusing on pre- and post-crime details, rather than the act of murder itself, the present study seeks to make these deceptive and honest statements as similar as possible.

The RM framework received mixed support. In contrast to the meta-analysis by Gancedo et al. (2021), there were no significant differences in the reporting of sensory details between the two groups. While tactile details did not differ between truthful and deceptive statements at the corrected α , the effect size suggests it may be more diagnostic than other sensory details, potentially due to tactile details being more challenging to realistically fabricate than the other sensory categories. Details relating objects and/or events to one another did differ significantly. Truth tellers reported significantly more spatial and motion details than liars. This may support the suggestion by some researchers (Vrij et al., 2010) that liars at times attempt to develop lies based on other experienced events or familiar settings, providing them with sufficient sensory information to fool investigators. However, while these past experiences may allow liars to provide sensory details, relativity details of the critical event are more complex and difficult to fabricate. As in some other studies (Sporer, 2004), no differences in the reporting of cognitive processes were found. In contrast, Gancedo et al. (2021) found a small ($d = -0.107$) effect for cognitive operation in the direction predicted by the RM framework. However, these disparate findings could be due to differences in how cognitive processes are operationally defined in each study, making results difficult to compare across studies (see Memon et al., 2010 for a further discussion). In general, we found weaker support for the RM model than, for example, Oberlader et al. (2016). This could be partly due to the fact that we used computerized scoring via LIWC. It has been argued that a shortcoming of the computerized approach is that it fails to capture impressionistic, gestalt-like elements of speech, which may contain actually valid cues (Hauch et al., 2015).

Implications

The results partially support the RM model of deception but also depart from it in meaningful ways. One of the possible reasons for this is that interrogation is a unique social interaction that entails a non-trivial amount of noise. The combination of high stakes for being believed, the physical settings, and tactics used by the interrogators may influence both the deliberate and unconscious choices that individuals make when choosing which words they use. While comparable, Mann et al. (2002) focused primarily on non-verbal behaviours, which are likely less diagnostic of deception than verbal cues. The 2002 study was limited to a single police agency, and utilized a within-subjects design including offenses ranging from relatively minor (theft) to serious (murder). The present study expanded the size and geographic range of its sample, allowing it to use a between-subjects design. It also narrowed its focus to a specific, and arguably one of the most serious, offense types. Sexually motivated murderers, who have not been previously studied in relation to deception

detection, maybe a unique population and may engage in different behaviours when lying in comparison to other forensic and non-forensic populations.

The results provide further support to the growing literature that verbal behaviours should be the focus of practitioners attempting to detect deception (DePaulo et al., 2003). While the average effect size of significant behavioural cues was found to be $d = 0.28$ in DePaulo et al. (2003) meta-analysis, the average effect size of the current study's significant variables was $d = 1.25$. These effect sizes may suggest that, under real-world conditions, there are sufficient differences between liars and truth-tellers that diagnostic criteria may be detectable by trained observers.

Limitations

The study is not without its limitations. While attempting to test theories using individual cues is problematic, as some may be ambiguous and result from several different processes, this is inherent in any attempt to interpret cues to deception. The non-random sample may not necessarily be representative of the larger population of sexual murderers, and the tactics utilized by interrogators may vary significantly from case to case. There may also be variability in how audiotapes were transcribed by the various reporting agencies. Due to agreements with the Behavioural Science Unit regarding access to the data, the first author, not blind to the research goals, was the only person to select the excerpts to be analysed. Although care was taken to make sample selections in a consistent way, this increases the risk of unintentional bias. The study compared true and false statements made during both confessions and denials. While the study's design attempted to limit any differences due to the social dynamics of these two types of statements, this is a possible confound. However, this study provides the most geographically and demographically diverse sample of real-life criminal suspects, while at the same time has focused on a single type of crime. It is also the first study, to the best of our knowledge, to utilize only physical evidence in establishing ground truth.

CONCLUSION

Future research may benefit from the comparison of true and false denials by criminal suspects. Given the current results, a comparison of sexually and non-sexually motivated homicide offenders may provide more insight into whether criminals are a homogenous group or are made up of smaller subgroups. This may help tailor future deception detection strategies for specific forensic populations.

In summary, this study expands on the limited body of research investigating the verbal differences between liars and truth-tellers in real-world, high-stakes lies. To the best of our knowledge, it is one of the first studies to specifically investigate how sexually motivated murderers behave during deception, and to exclusively assess verbal behaviours of liars and truth-tellers during police interrogations. It also exclusively relies on physical evidence to establish ground truth. This study's results partially support the notion that there are verbal cues to deception and provide a starting point to assess these cues in special forensic populations, particularly those that may be more adept at deceiving others.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the FBI's Behavioral Science Unit for coordinating access to the data used in this paper. Authors' opinions, statements, and conclusions should not be considered an endorsement by the FBI for any policy, program, or service.

CONFLICT OF INTEREST

All authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Andrew D. Thompson: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Writing – original draft; Writing – review & editing. **Maria Hartwig:** Methodology; Resources; Supervision; Writing – original draft; Writing – review & editing.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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How to cite this article: Thompson, A. D., & Hartwig, M. (2022). The language of high-stakes truths and lies: Linguistic analysis of true and deceptive statements made during sexual homicide interrogations. *Legal and Criminological Psychology*, 00, 1–11. <https://doi.org/10.1111/lcrp.12214>