# Lies, Lies and More Lies

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**Abstract**

Lying is a deliberate attempt to transmit messages that mislead others. Here, we examined the frequency of use of the so-called filler word 'um' during lying versus truth-telling in low-stakes laboratory-elicited lies (Study 1) and also in high-stakes real-life lies (Study 2). Results from a within-subjects false opinion paradigm showed that instances of 'um' occur less frequently during lying compared to truth-telling. Converging evidence was provided upon examining the lies of a convicted murderer. These results contribute to our understanding of linguistic markers of deception behaviour. More generally, they assist in our understanding of the role of utterances such as 'um' in communication. Utterances such as 'um' may not be accurately conceptualised as filled pauses/hesitations or speech disfluencies/errors whose increased usage coincides with increased cognitive load or increased arousal. Rather, they may carry a lexical status similar to interjections and form an important part of authentic, natural communication - that is somewhat lacking during lying.

**Keywords:** Deception, Lies.

## Linguistic Cues to Deception

Lying has been variously described as threatening the moral fabric of our society (Bok, 1978) and an important developmental milestone (deVilliers & deVilliers, 1978) that may be lacking in some developmental disorders (e.g., Autism Spectrum Disorders: Sodian & Frith, 1992). Certainly, lying is a part of everyday social interactions – with some studies suggesting that people lie on average once or twice a day (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996) – and may be prosocial in certain situations (Spence et al., 2004). Despite the frequency with which we are exposed to lies, people's ability to discriminate lies from truth is equal to that of chance (Bond & DePaulo, 2006). This inaccuracy appears to stem from a number of factors including undue reliance on nonverbal cues such as body movements (Mann, Vrij & Bull 2004). A recent study showed that even trained school teachers, social workers and police are poor deception detectors and they perform poorly regardless of whether the liars are 5-6 years of age, adolescents or adults (Vrij, Akehurst, Brown & Mann, 2006). Indeed, assessment of behavioural cues to deception is fraught with difficulty as these cues may be "subtle, dynamic and transitory [and therefore] often elude humans' conscious awareness" (Meservy, Jensen, Kruse, Burgoon & Nunamaker, 2005). The need for accurate deception detection in view of the poor performance of human lie detectors and other currently available methods (such as the polygraph which is suggested by some to be more of a *guilt* detector than a lie detector), has led to considerable research attention being focused on improving detection methods using formal, objective procedures. The current study provides an analysis of a particular aspect of language usage during lying vs. truth-telling – the prevalence of so-called filler words such as 'um'.

To date, researchers have investigated a wide range of language behaviours in both spoken and written output including measures of quantity, complexity, uncertainty, nonimmediacy, expressivity, diversity, redundancy, informality, specificity, causation and affect (e.g., see Bond & Lee, 2005; DePaulo, Lindsay, Malone, Muhlenbruck, Charlton & Cooper, 2003; Newman, Pennebaker, Berry & Richards, 2003; Rassin & Van Der Heijden, 2005; Sporer & Schwandt, 2006; Zhou, Burgoon, Nunamaker & Twitchell, 2004; Vrij, Edward, Roberts & Bull, 2000; Vrij & Mann, 2004). The results of studies that have examined multiple linguistic cues are impressive and some studies have demonstrated deception detection rates of 67% which is significantly better than the chance levels obtained by human lie detectors (e.g., Newman et al., 2003). A meta analysis of 120 deception studies conducted by DePaulo et al. (2003) found that, in general, liars provide fewer details, make more negative statements, sound more uncertain, impersonal, evasive and unclear, and produce more words that distance themselves from their statements and the person or people to whom they are lying when compared with truth-tellers. An important challenge for researchers working in this area is to focus on refining the definition and assessment of *particular* linguistic cues and to provide a more thorough explanation of *why* they are related to deceptive behaviour.

It has been suggested that utterances such as 'um' constitute filled pauses/hesitations (e.g., Maclay & Osgood, 1959) or production errors that render speech disfluent in a

similar way to repetitions, repairs and false starts (Chomsky, 1965; Clark & Wasow, 1998; Goldman-Eisler, 1968). Recent research has challenged such notions by suggesting that these utterances have lexical status like other English words. Clark and Fox Tree (2002) claimed that utterances such as 'um' have lexical status (a status that is perhaps similar to the open-class of words termed interjections which includes items such as 'alrighty' and 'woops') and that they have "conventional phonological shapes and meanings and are governed by the rules of syntax and prosody" (p. 3). Unrelated to research on deception, Clark and Fox Tree's analysis of 170,000 words from 50 face-to-face conversations demonstrated that speakers exhibit use of 'um' when marking delays in speaking (for example, in an attempt to keep the floor or cede the floor) and that they plan for, formulate and produce such utterances just as they would any other English word. A study of speech recognition in Spanish demonstrated that incorporation of such utterances as lexical items (rather than noise) in models of automatic speech recognition improves the recogniser's performance (Rodriguez & Torres, 2006).

Researchers in the area of deception have tended to theorise that 'um' may occur *more often* during lying than truth-telling. It has been argued that this increased prevalence may reflect a lack of language planning that accompanies the increased cognitive load (e.g., related to effortful monitoring of responses) and/or increased arousal (e.g., related to heightened feelings of guilt, fear or excitement) that often occurs during lying (e.g., Hosman & Wright, 1987; Vrij & Winkel, 1991). In the current study, we examined the possibility that 'um' may, in fact, appear *less* often during lying compared to truth-telling. We speculate that there are two reasons why this might be the case. The first relies on an assumption that lying is, at least to some degree, reflective of inauthentic and somewhat less natural processes compared to truth-telling. If 'um' forms a part of natural, effortless language use then we might expect to see less of it when language is inauthentic (i.e., during lying). In this sense, decreased use of 'um' during lying compared to truth-telling may not be under the direct control of the speaker. The second reason relies on the assumption that people may monitor their language use very carefully during lying and try to strategically remove or mask cues to deception. Thus, liars may deliberately reduce their use of 'um' in line with an understanding of 'um' being a hesitation or disfluency reflective of uncertainty (e.g., Akehurst, Köhnken, Vrij & Bull 1996; Vrij & Semin, 1996). In this sense, decreased use of 'um' during lying may be under the direct control of the speaker. In either case the result is the same – we would expect to see *decreased* use of 'um' during lying. In a first for deception research, we examined both low-stakes, laboratory-elicited lies (Study 1) and high-stakes, real-life lies (Study 2) to determine the role of 'um' as a useful linguistic marker.

## Study 1: Low-stakes Laboratory-elicited Lies

We elicited language in the context of an interactive 'interview' setting (rather than a monologue) for two reasons. First, we wanted to ensure a listener was present because it has been suggested that items such as 'um' may be used, consciously or otherwise, for the listener's benefit (as opposed to being reflective of the speaker's speech-planning processes). Second, the presence of a conversant may assist in encouraging speakers to lie convincingly.

### Method

**Participants** A total of 32 participants (22 females and 10 males) with an average age of 20.2 years (SD = 4.8) took part in exchange for course credit.

**Procedure** We employed a false opinion paradigm based on the procedure described by Frank and Ekman (2004) and participants took part in individual sessions lasting approximately 30 minutes. At the beginning of the session each participant was given a social issues questionnaire (on topics of general interest such as "Should smoking be banned in all enclosed public places?"). We asked each participant to provide their opinion on each topic (1 = *strongly disagree,* 7 = *strongly* agree) and to rate how strongly they personally felt about each issue (1 = *no feelings*, 7 = *very strong feelings*). Based on these responses we selected two topics for each participant for which participants held both a strong opinion (of either agreement or disagreement) and had strong feelings. Wherever possible, we chose issues for which the participant had reported an opinion rating of either one or seven and had also provided a value of seven for personal feelings about the issue. For one topic participants were asked to give a truthful account of their views and for the other topic participants were asked to provide an untruthful account of their views (i.e., to lie). The two selected topics were randomly assigned to be either the truthful or the untruthful account. The experimenter then told the participant that they would be asked to lie or tell the truth about their opinion on some of the social issues that had been presented to them in the social issues questionnaire during a video-taped interview (a different experimenter conducted the interviews).

**Data Preparation** Interviews were transcribed by a blinded research assistant and checked by a second blinded research assistant. An excerpt from an interview where the participant was discussing the topic of same sex marriage is as follows: *"…Um, well I think they're just like any other person so um they should just have the same chance as any other Australian to get married um and it's sort of up to them whether or not they want to…".* Tagging was undertaken by a sound engineer who was blind to the experimental conditions. In the tagging of 'um' instances, examples of 'uh' were not tagged as 'um' unless they were characterised by vowel nasalization (anticipatory

nasalization occurs when speakers intend to close with a nasal consonant such as /m/).

### Results

On average, participants produced 157.61 words when telling the truth and 174.35 words when lying. A 2 (condition: lying vs. truth-telling) x 2 (sex: female vs. male) ANOVA revealed no significant effects in terms of total number of words produced during lying vs. truth-telling (all Fs < 1). For each participant, we calculated the number of instances of 'um' as a percentage of the total number of words. Descriptive statistics regarding frequency of 'um' (as a percentage of total output) are provided in Table 1.

Table 1: Means (and standard deviations)

| | Truth | Lies |
|---|---|---|
| Female | 2.28 | 1.61 |
| | (1.42) | (1.34) |
| Male | 2.44 | 1.51 |
| | (2.54) | (1.42) |

The analysis of the percentage of 'um' utterances revealed a significant main effect of deception ($F(1,30) = 10.12$, $p = .003$) with significantly more instances in the truth-telling condition. In contrast, there was no main effect of gender and no interaction between gender and deception (both Fs < 1).

## Study 2: High-stakes Real-life Lies

Four weeks following the disappearance of his pregnant wife and prior to his subsequent arrest for her murder, key suspect Scott Peterson gave a series of media interviews prompting intense and often heated public speculation as to whether or not he was telling the truth when he protested his innocence. For several weeks prior to these interviews, police recorded hours of telephone conversations between Peterson and his mistress, Amber Frey – a person who Peterson initially believed was unaware he was even married, let alone the murderer of his wife and unborn child. The media interviews and taped telephone conversations all contained examples of lying and truthful speech. Here we present an analysis of the telephone conversations.

### Method

**Participant** Scott Lee Peterson, a North American Caucasian male, was arrested in April, 2003, for the murder of his wife, Laci Peterson, who disappeared on Christmas Eve, 2002. Peterson was subsequently charged and convicted under the California Penal Code of the double-murder of his pregnant wife and their unborn son in 2004. Peterson had no prior convictions. Peterson was sentenced to death and, at the time of writing, is on death row in San Quentin State Prison. He was born in San Diego, California, on October 24, 1972 and English is his first language. Peterson's highest level of academic achievement is a university degree in agricultural business and prior to his arrest he was employed as a fertilizer salesman.

**Case Details** Scott Peterson reported his wife, Laci Peterson, missing from their Modesto California home on December 24, 2002. The 27 year old was due to deliver her first child, to be named Conner, 6 weeks later. Peterson was interviewed by the police on several occasions and he was under police surveillance from early January 2003 - search warrants had been issued on his home, vehicles and place of business and he was clearly a person of interest in the case.

In the first police interview conducted on the day of Laci's disappearance, Peterson was asked if he was involved with another woman, to which he answered *no*. However, six days after Laci was reported missing, a Fresno woman by the name of Amber Frey contacted police to say she had been having a romantic relationship with Peterson for several weeks since November 19, 2002. She claimed that during that time Peterson had lied to her about his real circumstances - that he was a widower, his wife had recently died, he lived in Sacramento and he was flying to Paris for business over Christmas – and she had only been told of his real identity by a friend who recognised Peterson from news reports, the day of Frey's contact with police. Frey agreed to co-operate with police by secretly taping her telephone conversations with Peterson from December 31. He continued to call her throughout the time of the search for his pregnant wife during December and January, all the while maintaining the charade of a jet-setting widower.

The same day Frey first came forward (December 30, 2002), police asked Peterson if he had been having a relationship with another woman and once again he denied it. A week later, police confronted him with a photograph of Frey and once again he denied any involvement with her. Shortly after that (January 6, 2003), Peterson told Frey he had lied to her about his circumstances and confessed to her about the search for his missing pregnant wife. At the urging of police, Frey made a media statement on January 24, 2002 and so their affair became public knowledge. The telephone calls between Frey and Peterson continued after this time, and these too were taped by Modesto police. In response to the public outcry about Peterson's relationship with Frey, Peterson agreed to conduct four televised media interviews from January 27 – 29, 2002. Peterson was later found to have lied on at least one occasion during these interviews.

The bodies of Laci and Connor were discovered on the shores of San Francisco Bay on March 12, 2003. On April 18, 2003, Scott Peterson was arrested by police for the murders of his wife and unborn child and charged with double homicide. The case went to trial in June, 2004, with Peterson pleading not guilty of the charges. Transcripts of the four media interviews referred to above, in addition to audio presentations of the taped telephone conversations between Frey and Peterson, formed part of the prosecution's case against Peterson and were admitted as evidence at trial. Five months later the jury found him guilty of murder in the

first degree for his wife and murder in the second degree for his unborn son.

**Data Analysis** Transcriptions of The Frey Tapes and corresponding audio recordings were admitted as evidence at trial and were accessed through electronic material available on the public record at http://pwc-sii.com/CourtDocs/Pexhibits.htm. Prior to analysis of the speech data, each of the transcripts was carefully compared to the original audio to ensure they were a complete and verbatim record of the interviews.

The next step was to identify the portions of telephone conversation that could be verified as being truth or lie, a methodology that is congruent with the design employed by Vrij and Mann (2001), Mann, Vrij and Bull (2002) and Davis, Markus, Walters, Vorus and Connors (2005). This necessitated a strong familiarisation with the Trial Record and case information available on the public record. It was necessary to read through each of the transcripts line by line and isolate any utterances that could be strongly supported, by evidence presented at trial or from another reputable source (such as a police media release), as either truthful or deceptive. Deception may be defined as a deliberate attempt to manufacture, hide or manipulate information, in order to create a belief in others that the communicator knows to be false (Masip, Garrido & Herrero, 2004). In keeping with this definition, deceptive utterances were identified as those samples of speech where information was manufactured, hidden or manipulated. Fragments of speech that could not be verified were discarded from further analysis (e.g., all of Scott Peterson's personal opinions were eliminated from the data set).

An example of some speech from the deception condition: "Okay if you can hear me I'll be in Paris tomorrow. I'm taking a flight from here in the country in Normandy right now so I'll call you tomorrow." An example of some speech from the truth condition: "Um well I'll just I'll just tell you. Ah you haven't been watching the news obviously. Um I have not been traveling during the last couple weeks. I have I have lied to you that I've been traveling."

Of the remaining data, the number of words in the Lie and in the Truth conditions was counted as a measure of sample size. Data were analysed using the log likelihood ratio (LR) test (see Rayson & Garside, 2000). LR is less likely to overestimate significance than traditional statistical tests such as z-ratios that rely upon assumptions of a normal distribution. Similarly, where rare words are observed in frequency profiles, LR is less likely to overestimate the significance of such an event. Of particular relevance here, it has the added benefit of being suitable for comparison of relatively small texts and texts of differing lengths (Dunning, 1993; Rayson, Berridge & Francis, 2004). LR refers to the logarithm of the ratio between the likelihood that the truthful and deceptive speech inputs from the participant have the same linguistic profile and the likelihood that the linguistic profiles differ from each other. The sign preceding the log likelihood ratio (LR) shows the direction of the relationship, with '+' indicating a higher frequency in the truthful condition and '-' indicating a higher frequency in the deceptive condition.

### Results

There were 883 words in the deception condition and 1,077 words in the truth condition. The frequency of 'um' as a percentage of the total number of words in that condition are provided in Table 2.

Table 2: Linguistic behaviour as a function of veracity

| Truth | Lies | LR |
|---|---|---|
| 3.71 | 0.12 | +40.09 |

LR was statistically significant $p < .0001$.

## General Discussion

In a first for research on deception, we investigated the use of 'um' in both low-stakes laboratory-elicited lies and high-stakes real-life lies. The combination of these methods provides powerful converging evidence. Results from Study 1 indicated that during low-stakes laboratory-elicited lies instances of 'um' were significantly more frequent during truth-telling – their usage appeared to be restricted during lying. Results from Study 2 confirmed this pattern in high-stakes real-life lies.

We put forward two possible explanations for these findings. It may be that utterances such as 'um' are more accurately conceptualised as conventional English words rather than filled pauses/hesitations or speech disfluencies/errors (see Clark & Fox Tree, 2002; Fox Tree, 2006). Indeed, research unrelated to deception behaviours provides converging evidence for the special status of utterances such as 'um' which have been found to have different distribution patterns to other types of disfluencies such as repetitions and false starts. Bortfeld et al. (2001) found that these utterances "may be a resource for or a consequence of interpersonal coordination" (p. 123). As such, these utterances are an important part of authentic, natural speech (that is presumably somewhat lacking during lying). Accordingly, while the use of utterances such as 'um' may not be under strategic control we would expect usage to be lessened during lying (compared to truth-telling). The second possibility is that the use of utterances such as 'um' is under direct control and that participants reduce their usage during lying in an effort to mask deception. In line with this view, speakers remove what they see as markers of uncertainty (utterances such as 'um') when they lie (e.g., Akehurst et al., 1996; Vrij & Semin, 1996).

The outcome of each of these scenarios is the same – fewer utterances such as 'um' during lying. Importantly, while it seems possible that the number of instances of 'um' (i.e., frequency of use) may be under strategic control it seems unlikely that other acoustic characteristics of these

utterances, such as duration and amplitude, could be as easily controlled in a straightforward way. However, this remains an open empirical question to be investigated in future studies.

A question that is often raised in research on linguistic cues to deception is whether rehearsal affects lying. So-called 'fillers' are thought to be used less often in rehearsed speech. It might be speculated that Peterson was able to rehearse his lies but is it the case that people's familiarity with arguments concerning current social issues resulted in the use of 'rehearsed speech'? Over time, people might become increasingly aware of both sides of the argument concerning particular social issues; however, we imagine that if there is any significant rehearsal involved, this would relate to one side of an argument more than the other (most likely, the side that the participant believes in, their 'truth'). Thus, we might have expected to see *fewer* so called fillers in the truthful condition during laboratory-elicited lies as this condition is more likely to reflect speech that participants have, personally, rehearsed a number of times. Our results showed the opposite pattern of results (fewer fillers during lying).

Of all the potential linguistic cues to investigate in deceptive speech, frequency of 'um' may offer two advantages in English-speaking forensic contexts. First, when viewed as legitimate lexical terms, they lend themselves to automation (as just like any other word they can be identified and counted using basic part-of-speech tagging systems) and, second, they may be somewhat independent of the content of the communication. For example, Newman et al. (2003) found that a number of linguistic markers of deception identified in accounts about abortion were more predictive within the topic than across topics (e.g., first person pronouns, exclusive words, motion verbs and negative emotion words) – suggesting a relationship between subject matter and language behaviour. By contrast, 'um's are more likely to be individual stylistic markers (Shriberg, 2001) that are attached to the person rather than the context and hence it is their relative use in truth-telling versus deception that may provide clues to veracity. Such context-independence is valuable in real-world settings where the speech of the speaker cannot always be constrained. Of course, the accompanying down-side of speaker-dependent cues to deception, particularly in automated systems, is the importance of establishing base-line measures of the target variable before any demarcations from this can be noted and interpreted.

Avenues for future research include investigation of utterances such as 'um' in participants who are 'practiced liars' (e.g., one might compare poker players and non-poker players using the laboratory-elicited methods described here). It would also be interesting to experimentally manipulate cognitive load using laboratory-elicited methods. As suggested by Vrij, Fisher, Mann and Leal. (2006) participants could be asked to engage in a secondary (unrelated) cognitive task while being interviewed (i.e., while they are telling the truth and, also, while they are lying) to more precisely examine the effects of cognitive load on lying.

## References


Akehurst, L., Köhnken, G., Vrij, A., & Bull, R. (1996). Lay persons' and police officers' beliefs regarding deceptive behavior. *Applied Cognitive Psychology*, *10*, 461-473.

Bok, S. (1978). *Lying: Moral choices in public and private life*. New York: Vintage Books.

Bond, C. F., Jr., & DePaulo, B. M. (2006). Accuracy of deception judgments. *Personality & Social Psychology Review*, *10*, 214-234.

Bond, G. D., & Lee, A. Y. (2005). Language of lies in prison: Linguistic classification of prisoners' truthful and deceptive natural language. *Applied Cognitive Psychology*, *19*, 313-329.

Bortfeld, H., Leon, S., Bloom, J., Schober, M., & Brennan, S. (2001). Disfluency rates in conversation: Effects of age, relationship, topic, role, and gender. *Language and Speech*, *44*, 123-147.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.

Clark, H. H., & Fox Tree, J. E. (2002). Using uh and um in spontaneous speaking. *Cognition*, *84*, 73-111.

Clark, H. H. & Wasow, T. (1998). Repeating words in spontaneous speech. *Cognitive Psychology, 37*, 201-242.

Davis, M., Markus, K. A., Walters, S. B., Vorus, N., & Connors, B. (2005). Behavioral cues to deception vs. topic incriminating potential in criminal confessions. *Law & Human Behavior*, *29*, 683-704.

DePaulo, B. M., Kashy, D. A., Kirkendol, S. E., Wyer, M. M., & Epstein, J. A. (1996). Lying in everday life. *Journal of Personality and Social Psychology*, *70*, 979-995.

DePaulo, B. M., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to Deception. *Psychological Bulletin*, *129*, 74-118.

deVilliers, J. G., & deVilliers, P. A. (1978). *Language acquisition*. Cambridge, MA: Harvard University Press.

Dunning, T. (1993). Accurate methods for the statistics of surprise and coincidence. *Computational Linguistics*, *19*, 61-74.

Fox Tree, J. (2006). Placing *like* in telling stories. *Discourse Studies, 8,* 723-743.

Frank, M. G., & Ekman, P. (2004). Appearing truthful generalizes across different deception situations. *Journal of Personality and Social Psychology*, *86*, 486-495.

Goldman-Eisler, F. (1968). *Psycholinguistics:Experiments in spontaneous speech*. New York: academic Press.

Hosman, L., & Wright, J. (1987). The effects of hedges and hesitations on impression formation in a simulated courtroom context. *Western Journal of Speech Communication*, *51*, 173-188.

Maclay, H., & Osgood, C. (1959). Hesitation phenomena in spontaneous English speech.*Word*, *15*, 19-44.

Mann, S., Vrij, A., & Bull, R. (2002). Suspects, lies, and videotape: An analysis of authentic high-Stake Liars. *Law & Human Behavior*, *26*, 365-376.

Mann, S., Vrij, A., & Bull, R. (2004). Detecting true lies: Police offers' ability to detect deceit. *Journal of Applied Psychology*, *89*, 137-149.

Masip, J., Garrido, E., & Herrero, C. (2004). Defining deception. *Anales de Psicologia*, *20*, 147-171.

Meservy, T. O., Jensen, M. L., Kruse, J., Burgoon, J. K., & Nunamaker, J. F. (2005). Automated extraction of deceptive behavioral cues from video. In P. Kantor (Ed.), *Intelligence and Security Informatics* (pp. 198-208). Berlin: Springer.

Newman, M. L., Pennebaker, J. W., Berry, D. S., & Richards, J. N. (2003). Lying words: Predicting deception from linguistic styles. *Personality and Social Psychology Bulletin*, *29*, 665–675.

Rassin, E., & Van Der Heijden, S. (2005). Appearing credible? Swearing helps! *Psychology, Crime & Law*, *11*, 177-182.

Rayson, P., Berridge, D., & Francis, B. (2004, March). *Extending the Cochran rule for the comparison of word frequencies between corpora.* Paper presented at the 7th International Conference on Statistical Analysis of Textual Data, Louvain-la-neuve, Belgium.

Rayson, P., & Garside, R. (2000). Comparing corpora using frequency profiling. In A. Kilgariff & T. Sardinha (Eds.), *Proceedings of the workshop on comparing corpora held in conjunction with the 38th annual meeting of the Association for Computational Linguistics* (pp.1-6). Hong Kong: ACL.

Rodriguez, L., & Torres, M. (2006). Spontaneous speech events in two speech databases of human-computer and human-human dialogs in Spanish. *Language and Speech*, *49*, 333-366.

Shriberg, E. (2001). To 'errrr' is human: Ecology and acoustics of speech disfluencies. *Journal of the International Phonetic Association*, *31*, 153-169.

Sodian, B., & Frith, U. (1992). Deception and sabotage in autistic, retarded and normal children. *Journal of Child Psychology and Psychiatry*, *33*, 591-606.

Spence, S. A., Hunter, M. D., Farrow, T. F., Green, R. D., Leung, D. H., Hughes, C. J., et al. (2004). A cognitive neurobiological account of deception: Evidence from functional neuroimaging. *Philosophical Transactions of the Royal Society of London B*, *359*, 1755-1762.

Sporer, S. L., & Schwandt, B. (2006). Paraverbal indicators of deception: A meta-analytic synthesis. *Applied Cognitive Psychology*, *20*, 421-446.

Vrij, A., Akehurst, L., Brown, L., & Mann, S. (2006). Detecting lies in young children, adolescents and adults. *Applied Cognitive Psychology*, *20*, 1225-1237.

Vrij, A., Edward, K., Roberts, K.P., & Bull, R. (2000). Detecting deceit via analysis of verbal and nonverbal behavior. *Journal of Nonverbal Behaviour*, *24*, 239-264.

Vrij, A., Fisher, R., Mann, S., & Leal, S. (2006). Detecting deception by manipulating cognitive load. *Trends in Cognitive Sciences, 10*(4), 141-142.

Vrij, A., & Mann, S. (2001). Telling and detecting lies in a high-stake situation: The case of a convicted murderer. *Applied Cognitive Psychology*, *15*, 187-203.

Vrij, A., & Mann, S. (2004). Detecting deception: The benefit of looking at a combination of behavioral, auditory and speech content related cues in a systematic manner. *Group Decision & Negotiation*, *13*, 61-79.

Vrij, A., & Semin, G. (1996). Lie experts' beliefs about nonverbal indicators of deception. *Journal of Nonverbal Behaviour*, *20*, 65-80.

Vrij, A., & Winkel, F. (1991). Cultural patterns in Dutch and Surinam nonverbal behaviour: an analysis of simulated police/citizen encounters. *Journal of Nonverbal Behaviour*, *14*, 169-184.

Zhou, L., Burgoon, J. K., Nunamaker, J. F., & Twitchell, D. (2004). Automating Linguistics-Based Cues for Detecting Deception in Text-Based Asynchronous Computer-Mediated Communications. *Group Decision & Negotiation*, *13*, 81-106.