# Cry Me a River: Identifying the Behavioral Consequences of Extremely High-Stakes Interpersonal Deception

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# Cry Me a River: Identifying the Behavioral Consequences of Extremely High-Stakes Interpersonal Deception

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Deception evolved as a fundamental aspect of human social interaction. Numerous studies have examined behavioral cues to deception, but most have involved inconsequential lies and unmotivated liars in a laboratory context. We conducted the most comprehensive study to date of the behavioral consequences of extremely high-stakes, real-life deception—relative to comparable real-life sincere displays—via 3 communication channels: speech, body language, and emotional facial expressions. Televised footage of a large international sample of individuals ($N = 78$) emotionally pleading to the public for the return of a missing relative was meticulously coded frame-by-frame (30 frames/s for a total of 74,731 frames). About half of the pleaders eventually were convicted of killing the missing person on the basis of overwhelming evidence. Failed attempts to simulate sadness and leakage of happiness revealed deceptive pleaders' covert emotions. Liars used fewer words but more tentative words than truth-tellers, likely relating to increased cognitive load and psychological distancing. Further, each of these cues explained unique variance in predicting pleader sincerity.

*Keywords:* deceptive behavior, emotional facial expression, body language, verbal/linguistic cues

Interpersonal deception has evolved to be a common, fundamental aspect of human social interaction. Despite people's experience with deceiving and being deceived by others, lies are notoriously difficult to detect; most observers—including relevant professionals such as law enforcement—do no better than flipping a coin (e.g., Ekman & O'Sullivan, 1991; Vrij & Mann, 2001b; see Vrij, Granhag, & Porter, 2011). Nonetheless, observers typically are confident in their ability to spot signs of deception and threat, potentially leading to a range of consequential mistakes, from undetected terrorists to wrongful convictions (Weinberger, 2010). Although humans are more proficient liars than lie detectors, deceivers too face a difficult task. In particular for "high-stakes" lies, a deceiver must construct a consistently detailed story and communicate the deceptive information—via facial expression, speech, and body language communication channels—in a way that will maximize his or her apparent credibility.

Although the majority of studies on deceptive behavior has examined low-stakes lies of little consequence (Porter & ten Brinke, 2010), deceptive behavior can depend heavily on the potential outcome for the liar, such that lies of consequence are associated with more salient behavioral signs (the "motivational impairment effect"; DePaulo & Kirkendol, 1989). High-stakes lies can be accompanied by powerful emotions—fear, remorse, anger, or even excitement—that must be inhibited or convincingly faked. Consider the husband publicly pleading for the safe return of his missing wife who he has murdered. He must monitor his body language and mask genuine emotional facial expressions while creating a believable story and considering the enormous consequences of getting caught. Given the difficulty of this task, "leaked" signals of increased cognitive load, emotional arousal, impression management, and psychological distancing may reveal the liar's duplicity. The knowledgeable lie detector can take notice of such behavioral leakage, using the existence of multiple indicators of deceit to bolster confidence in a determination of dishonesty. Indeed, Porter and ten Brinke (2010) advocated the multiple-cue approach to lie detection wherein the occurrence of multiple, empirically validated indicators of deception (or truth) can increase the credibility assessor's confidence in his or her determination.

## Consequences of Emotional Arousal

The face is the dynamic canvas on which humans express emotional states and from which they infer those of others. However, humans evolved to alter their facial expressions to facilitate deception (Livingstone Smith, 2004). Although attempts to feign or inhibit emotional expressions often are successful, it has long been assumed that attention to certain aspects of facial expression can betray such duplicity. Drawing on pioneering work by Duchenne (1862), Darwin (1872) observed, "A man when moderately angry, or even when enraged, may command the movements of his body, but . . . those muscles of the face which are least obedient to the will, will sometimes alone betray a slight and passing emotion"

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(p. 79). He hypothesized that some facial muscle actions associated with strong emotion are beyond voluntary control and cannot be completely inhibited. Further, he proposed that certain facial muscles cannot be intentionally engaged during emotional simulation. Collectively, these two propositions form the *inhibition hypothesis*, a proposal with enormous relevance to human communication (Ekman, 2003a). A related proposition is that microexpressions—1/25th to 1/5th of a second in length, full-face expressions that reveal one's true emotions, and quickly suppressed by a liar—are a valid cue to deception (Ekman & Friesen, 1969).

Despite delayed empirical investigation of Darwin's hypothesis, it finally is gathering scientific support. By examining hundreds of genuine and falsified expressions of universal emotions in the laboratory context, researchers have found that involuntary leakage of emotion is ubiquitous; no one seems able to falsify emotions without such betrayals on some occasions, most often occurring during negative emotional displays (Porter & ten Brinke, 2008). Emotional leakage is more likely to be present and last longer in masked versus genuine expressions, particularly when suppressing an intense, relative to a weak, emotion (Porter, ten Brinke, & Wallace, in press). However, unintended expressions generally are subtle and appear in the upper or lower face only (e.g., a smirk when attempting to appear sad), and "microexpressions" are rare. Contrary to Ekman and Friesen's (1975) description, these brief expressions did not include the entire face and sometimes occurred during genuine emotional displays (see also Porter et al., in press). Further, masking one's true emotion is associated with increased blink rate, and neutralizing emotion is associated with decreased blinking in laboratory and high-stakes settings (Leal & Vrij, 2010; Mann, Vrij & Bull, 2002; Porter & ten Brinke, 2008).

## Consequences of Cognitive Load

The preparation of a lie is likely to be a mentally taxing task; the guilty murderer must inhibit the truth, construct an alibi that sounds plausible and is consistent with facts known to police, and avoid implicating himself or herself in the crime. In contrast, the truth-teller simply must recall and relate his or her memory for the event in question. Further, because liars are less likely to take their credibility for granted, they are likely to monitor their speech, body language, and facial expression more closely than truth-tellers, amplifying the cognitive demand associated with providing a deceptive alibi (Vrij, 2008).

Behavioral manifestations of increased cognitive load include a slowed speech rate, longer pauses, and increased speech hesitations (e.g., *um*, *ah*, *er*), allowing the liar more time to construct a plausible story (Vrij, 2005; Vrij & Mann, 2001a). The difficulty of this task also may result in an increase in speech errors, relative to the truth-teller. The liar may also neglect his or her body language while preoccupied with the challenges of deception. As such, deception generally is associated with fewer hand and arm movements that naturally accompany speech to illustrate the narrative content (at least in low-stakes laboratory situations with student participants; DePaulo et al., 2003).

## Consequences of Attempted Behavioral Control

Elements of the cognitive load experienced during deception may, in part, be attributed to the liar's attempts to consciously control his or her behavior in an effort to appear honest. However, attempts to portray credibility via behavior are likely to fail for several reasons. First, some behavioral channels are outside conscious control. As noted by Darwin (1872), particular facial muscles least amenable to volitional control may reveal our true emotions and intentions. Second, the liar may not have an adequate understanding of how he or she appears when truth-telling and, related to that point, attempts to control behavior may be overly vigorous. Liars may overcompensate in their efforts to avoid common misconceptions about deceptive behavior. For example, in attempting not to avert his or her gaze from the recipient's eyes, the liar may stare too long and too hard (Mann et al., 2011). Similarly, efforts to avoid excessive fidgeting may result in reduced and overly controlled, rigid body movements (DePaulo et al., 2003; Vrij, 2008).

Potentially because body movements are under greater conscious control than facial or verbal indicators of deception, reliable findings with student samples do not generalize well to criminal populations or high-stakes situations (Porter & ten Brinke, 2010). Whereas a reduction in illustrator use (hand or arm movements supplementing speech) commonly is related to deception in laboratory settings with student samples, studies with criminal populations suggest that these skilled deceivers do not follow this pattern and, instead, may use more movements (e.g., illustrators, self-manipulators) to distract the receiver from inadequacies of the false message (DePaulo et al., 2003; Klaver, Lee, & Hart, 2007; Porter, Doucette, Earle, & MacNeil, 2008). In a pair of studies examining truthful and deceptive behavior of criminals in police interviews, no such cues were found to differ across veracity (Mann et al., 2002; Vrij & Mann, 2001a).

## Consequences of Psychological Distancing

Empirical and anecdotal evidence suggests that (relative to other channels) there is much value in attending to language in catching liars (Vrij, 2008). Previous research has established the validity of criteria-based content analysis and reality monitoring, based on cognitive theory, but these approaches require a lengthy statement for analysis and do not account for the more idiosyncratic indicators of deceit revealed by specific linguistic choices made by the liar (Porter & ten Brinke, 2010).

Attempts to create a psychological distance between the liar and the truth—potentially in a nonconscious effort to increase the ease of deception—may result in characteristically deceptive word usage. Using computerized linguistic software (Linguistic Inquiry and Word Count [LIWC]; Pennebaker, Francis, & Booth, 2001), laboratory studies have found that liars tend to use fewer first-person pronouns (to avoid accepting responsibility), more negative emotion words (revealing feelings of guilt), and more tentative words such as *maybe* and *perhaps* (avoiding commitment to the lie; Newman, Pennebaker, Berry, & Richards, 2003; Zhou, Burgoon, Nunamaker, & Twitchell, 2004). Given that these cues are presumed to occur outside of the liar's conscious awareness, they are less susceptible to manipulation and thus also appear in lies told by relatively sophisticated deceivers (criminal populations) and in real-world situations (Bond & Lee, 2005; Harpster, Adams, & Jarvis, 2009).

## The Current Study

In this study, we investigated the behavioral consequences of high-stakes deception related to each of these theoretical orientations using a unique sample: We examined the videotaped behaviors of a large international sample of individuals emotionally pleading to the public for the return of a missing relative. In approximately half of these cases, the pleader ultimately was determined—via powerful evidence and a guilty verdict in court—to have murdered the relative prior to the public appeal. Honest pleaders are, of course, genuinely and desperately seeking the return of their loved one. Such televised pleas typically include a description of the missing person, the pleader's experience with the recent events, words of thanks to those assisting with the search, and a direct appeal. In the direct appeal, the pleader asks the perpetrator to let the missing person go, the missing person to make contact, or the public to assist search parties. The critical lie, told by deceptive murderers, occurs during the direct appeal wherein they ask for assistance in the safe return of the missing person while harboring knowledge that this request cannot possibly be fulfilled. Thus, although the deceptive pleader plays the role of the concerned relative throughout the entire plea and behavioral cues differentiating genuine and deceptive pleaders may be present, it was expected that the direct appeal was most likely to reveal cues to deceit.

Pleas were exhaustively coded for behavioral (speech, body language, and emotional facial expression) indicators of emotional arousal, cognitive load, attempted behavioral control, and psychological distancing, related to several specific hypotheses.

*Hypothesis 1:* Relative to genuine pleaders, deceptive murderers were expected to fail in producing convincing sadness and distress expressions, and leak more discordant emotions (i.e., happiness), as a result of their qualitatively distinct emotional arousal.

*Hypothesis 2:* Increased cognitive load experienced by liars was expected to result in a slower speech rate, the use of fewer words, and increased speech hesitations, compared with genuinely distressed individuals.

*Hypothesis 3:* Attempts by liars to create psychological distance were expected to result in a decrease in pronoun use and emotional words and an increase in tentative (noncommittal) words by deceivers, relative to genuine pleaders.

*Hypothesis 4:* It was expected that body language under conscious control (i.e., illustrator and facial-manipulator use, gaze aversion) could be successfully maintained by deceivers. However, blink rate—as a potentially controllable but largely involuntary reflex—was expected to increase because of arousal associated with emotional masking, relative to genuine emotional expression by truth-tellers.

*Hypothesis 5:* Complementing this holistic examination of behavioral leakage, it was expected that the multicue approach to deception detection would be supported. That is, it was expected that valid cues, particularly those aligned with different theoretical orientations, would account for unique variance in predicting pleader sincerity (Porter & ten Brinke, 2010).

## Method

### Cases

Videos of 78 (35 deceptive) individuals who made televised pleas for the safe return (or information leading to the arrest of an unknown suspect in the murder) of their relative were gathered from news agencies in Australia, Canada, the United Kingdom, and the United States (see Table 1 for sample characteristics). The majority of individuals ($n = 52$) included a direct appeal to the perpetrator to let the missing person go, to the missing person to make contact, or to the public for assistance, in their televised plea.

### Determination of Ground Truth

To ensure the internal validity of this study, we used a strict definition of "ground truth" to discriminate deceptive and honest pleaders, similar to the criteria used by Vrij and Mann (2001b). To establish that a pleader was "deceptive" and include him/her in the sample, we required that overwhelming evidence existed to discredit the sincerity of his or her emotional appeal and to establish that he or she had been involved in the murder of the missing individual. Based on this overwhelming evidence, each of the deceptive individuals eventually was convicted of involvement in the missing individual's death in a criminal court. Evidence included presence of the victim's blood, other DNA (hair, skin), forensic evidence (pollen traces, tire tracks), possession of the murder weapon, security camera footage, phone range or tap information, confessions (not recanted), leading police to the victim's body, incriminating monetary transactions, inadequate alibis, and eyewitness testimony. The majority of cases were classified as genuine or deceptive on the basis of multiple pieces of the above evidence. For example, one husband pleaded for the return of his pregnant wife, but eventually was convicted of her murder after video surveillance surfaced of him running from the crime scene immediately following the murder and the victim's bloody clothes were found in his closet and vehicle. In another case, a mother

Table 1
*Sample Characteristics*

| Characteristic | Complete pleas | | Direct appeal | |
|---|---|---|---|---|
| | Genuine ($n = 43$) | Deceptive ($n = 35$) | Genuine ($n = 26$) | Deceptive ($n = 26$) |
| Gender of pleader | | | | |
| Male | 22 | 26 | 13 | 18 |
| Female | 21 | 9 | 13 | 8 |
| Relationship to missing or murdered person | | | | |
| Parent–child | 35 | 18 | 21 | 13 |
| Spouse or partner | 1 | 20 | 0 | 14 |
| Sibling | 3 | 1 | 2 | 1 |
| Grandparent–grandchild | 3 | 0 | 2 | 0 |
| Other | 6 | 5 | 2 | 3 |

*Note.* Relationship totals exceed sample size because of several cases of multiple homicide.

confessed to and provided intimate and nonpublicized details of killing her child after being confronted with admissions she made in phone conversations that were tapped by police. In cases of genuine pleaders ($n = 43$), someone else had been convicted on the basis of similarly overwhelming evidence ($n = 34$), the relative was found alive with his or her abductor ($n = 3$), the relative had committed suicide ($n = 4$), or the missing person was later located in the absence of foul play ($n = 2$). Table 2 provides a summary of evidence used to determine ground truth in genuine and deceptive cases.

## Coding Procedure

Each video was comprehensively coded (by trained coders, blind to veracity) for behavioral (rate of illustrators, face manipulations, and blinks, and proportion of gaze aversion) and emotional facial signals of deception (presence of universal emotional expressions). Illustrators were defined as any movement or gesture of the arms or hands used to supplement speech. Facial manipulations were any instance in which the participant touched, scratched, or covered his or her face (Porter et al., 2008). A blink was coded as any instance in which the eyelids met, and gaze aversion was operationally defined as the proportion of time during which the pleader avoided eye contact with the interviewer, the crowd to whom he or she spoke, and the video camera.

Emotional facial expressions occurring during each plea were coded using the reliable and valid procedure developed by Porter and ten Brinke (2008) and Porter et al. (in press). This method was favored for its relative ease and efficiency over the Facial Action Coding System (FACS; Ekman, Friesen, & Hagar, 2002). Porter and ten Brinke's (2008) coding system is easily translated into practical recommendations for relevant professionals, and also allowed us to isolate particular facial areas of interest for future, intensive FACS coding (e.g., ten Brinke, Porter, & Baker, 2011). Training in this method involves facial musculature recognition, memorization of facial action units associated with universal emotions, and identification of universal emotions. This training is based in part on the FACS, with specific attention to those action units associated with variants of universal emotional expressions (Emotion Facial Action Coding System). Universal emotions include happiness, sadness, fear, disgust, anger, surprise, and contempt (Ekman & Friesen, 1975; Ekman et al., 1987). Pictures of Facial Affect (Ekman & Friesen, 1976) also were studied as prototypical examples of each emotion. Coding involves classifying the emotional expression in each 1/30-s frame of video in the upper and lower facial regions independently (see Porter & ten Brinke, 2008, for further information on coding procedures and training). A total of 74,731 frames were coded twice: once for emotional presentation in the upper and again in the lower face, for a total of 149,462 codes.

Table 2
*Frequency of Case Evidence Used to Establish Ground Truth*

| Evidence type | Genuine ($n = 43$) | Deceptive ($n = 35$) |
|---|---|---|
| Victim's blood | 10 | 10 |
| DNA (hair, skin, etc.) | 3 | 10 |
| Forensic evidence (pollen traces, tire tracks, etc.) | 15 | 25 |
| Possession of murder weapon | 2 | 1 |
| Security camera footage | 7 | 10 |
| Phone range or tap information | 7 | 5 |
| Confession (not recanted) | 13 | 14 |
| Led police to victim's body | 5 | 7 |
| Incriminating monetary transactions | 5 | 1 |
| Inadequate alibi | 11 | 3 |
| Eyewitness testimony | 5 | 1 |

*Note.* Totals exceed sample size because majority of cases were classified based on several pieces of evidence.

Verbal cues including length of plea in words, speech rate (words per minute), percentage of words that were speech hesitations (e.g., *um*, *ah*), pronouns (e.g., *I*, *our*), tentative words (e.g., *maybe*, *guess*), and positive (e.g., happy, joy) and negative emotions (e.g., grief, sad, hate) were calculated using LIWC (Pennebaker et al., 2001). This text analysis program reliably counts words in psychologically relevant categories and quickly is advancing our understanding of linguistic properties of deception (Tausczik & Pennebaker, 2010).

## Coding Reliability

A second trained coder examined body language and emotional cues in 17 (21.8%) videos to assess interrater reliability. For all body language variables, coders were highly reliable ($r$s = .87−.99). The dichotomously coded presence (or absence) of emotions in the upper and lower face also was highly reliable ($\kappa = .67$, $p < .001$, 87.8% agreement; Krippendorff, 1980).

# Results

In a comprehensive and theoretically driven approach, examining each of the stated hypotheses during the entire plea and direct appeal separately, we conducted a series of binary logistic regressions and multivariate analyses of variance (MANOVAs). Logistic regressions were used to examine the presence or absence of each facial expression (i.e., dichotomous data) as a predictor of pleader veracity (Hypothesis 1). For the continuous verbal and body language variables, MANOVAs were conducted to examine Hypotheses 2–4, with pleader veracity serving as a between-subjects independent variable. Finally, logistic regression also was performed to test Hypothesis 5.

## Complete Plea Predictors

Results of a series of logistic regression analyses revealed that significant predictors of deceit included the presence of lower face disgust and the absence of sadness in the upper and lower face, supporting Hypothesis 1. Whereas 14 (40.0%) of liars expressed lower face disgust, only seven (16.3%) of genuine pleaders did the same ($\beta = 1.23$, Wald $\chi^2 = 5.24$, $p < .05$, odds ratio [OR] = 3.43). In contrast, liars were less likely to express upper ($\beta = -1.01$, Wald $\chi^2 = 4.53$, $p < .05$, OR = 0.36) or lower ($\beta = -1.34$, Wald $\chi^2 = 6.61$, $p < .05$, OR = 0.26) face sadness/distress. Twenty-four (55.8%) and 21 (48.8%) of truthful pleaders expressed upper and lower face sadness, respectfully. In contrast, only 11 (31.4%) and seven (20.0%) of deceptive pleaders were able to express the same.

Examining Hypothesis 2, we conducted a MANOVA with veracity as a between-subjects independent variable and speech rate,

word count, and proportion of speech hesitations as dependent variables. However, the multivariate test was not significant, $F(3, 73) = 2.10$, $p > .05$, partial $\eta^2 = .08$. In contrast, support was found for psychological distancing in linguistic profiles of deceptive pleaders (Hypothesis 3), $F(4, 73) = 2.69$, $p < .05$, partial $\eta^2 = .13$. Follow-up univariate analyses revealed that deceptive pleaders ($M = 8.44$, $SD = 6.39$) used a greater percentage of tentative words throughout their appeals relative to truth-tellers ($M = 4.84$, $SD = 4.64$), $F(1, 76) = 8.30$, $p < .01$, partial $\eta^2 = .10$. However, the percentage of pronouns and positive emotional and negative emotional words did not differ across pleader veracity, $p > .05$. Finally, Hypothesis 4 was examined by conducting a MANOVA with proportion of gaze aversion and blink rate as dependent variables. Unfortunately, several (controllable) body language cues (i.e., illustrators, self-manipulators) occurred too rarely to be included in meaningful statistical analyses. As expected, the multivariate analysis was not significant, $F(2, 74) = 0.48$, $p > .05$, partial $\eta^2 = .01$.

## Direct Appeal Predictors

During the direct appeal portion of the plea (provided by $n = 52$ pleaders), behavioral differences between truth-tellers and deceivers were expected to be more salient, relative to the complete plea. See Table 3 for descriptive statistics concerning each variable of interest. Supporting Hypothesis 1, logistic regression analyses revealed that the presence of upper face surprise ($\beta = 1.75$, 95% CI [0.62, 3.44], Wald $\chi^2 = 7.52$, $p < .05$, OR = 5.73) and lower face happiness ($\beta = 1.20$, 95% CI [0.00, 2.82], Wald $\chi^2 = 3.91$, $p < .05$, OR = 3.33) each significantly predicted deception. Liars

Table 3
*Descriptive Statistics for Each Cue During the Direct Appeal*

| | Mean (*SD*) of continuous variables | | Events per variable (frequency of presence) | |
|---|---|---|---|---|
| Cue | Genuine ($n = 26$) | Deceptive ($n = 26$) | Genuine ($n = 26$) | Deceptive ($n = 26$) |
| | | Verbal | | |
| Word count | 47.77 (39.52) | 22.47 (14.73) | 26 | 26 |
| Speech rate (/min) | 147.68 (55.62) | 141.50 (49.25) | 26 | 26 |
| Speech hesitations (%) | 1.34 (2.32) | 1.07 (2.64) | 8 | 5 |
| Pronouns (%) | 16.13 (8.72) | 17.48 (7.76) | 24 | 24 |
| Tentative words (%) | 5.24 (6.13) | 13.94 (9.50) | 19 | 23 |
| Positive emotion (%) | 0.74 (1.57) | 1.69 (3.71) | 6 | 7 |
| Negative emotion (%) | 1.41 (2.70) | 0.47 (1.73) | 10 | 3 |
| | | Body language | | |
| Illustrators (/min)[a] | 0.58 (2.50) | 0.05 (0.28) | 3 | 1 |
| Face manipulators (/min)[a] | 0.57 (1.95) | 1.54 (5.49) | 2 | 2 |
| Blink (/min) | 29.81 (22.45) | 41.62 (31.62) | 26 | 24 |
| Gaze aversion (%) | 13.76 (27.01) | 27.82 (35.18) | 12 | 15 |
| | | Emotion (presence) | | |
| Upper face | | | | |
| Happiness[a] | | | 0 | 3 |
| Sadness | | | 11 | 6 |
| Fear[a] | | | 1 | 2 |
| Anger | | | 11 | 6 |
| Disgust[a] | | | 3 | 5 |
| Contempt[a] | | | 0 | 0 |
| Surprise | | | 5 | 15 |
| Lower face | | | | |
| Happiness | | | 6 | 13 |
| Sadness | | | 10 | 4 |
| Fear | | | 6 | 6 |
| Anger | | | 7 | 6 |
| Disgust | | | 3 | 8 |
| Contempt[a] | | | 0 | 1 |
| Surprise[a] | | | 1 | 1 |
| | | Microexpressions | | |
| Upper face[a,b] | | | 3 | 2 |
| Lower face[a,c] | | | 5 | 4 |
| Full face[a,d] | | | 2 | 0 |

[a] Variables rarely present and excluded from further analysis (e.g., Hosmer & Lemeshow, 2000). [b] Upper face microexpressions by the three genuine pleaders included two expressions of anger and one of surprise. The two deceptive pleaders who revealed upper face microexpressions both expressed sadness. [c] Lower face microexpressions revealed by five genuine pleaders included five expressions of sadness, two of happiness, and one of disgust. Of the four deceptive pleaders leaking microexpressions, two revealed happiness, one revealed disgust, and the other revealed fear. [d] Full-face microexpressions occurred only in genuine pleas; two genuine pleaders revealed a total of five brief flashes of sadness.

were more likely to express upper face surprise ($n = 15$ or 57.7% liars vs. $n = 5$ or 19.2% truth-tellers) and leak lower face happiness (i.e., a smirk; $n = 13$ or 50.0% liars vs. $n = 6$ or 23.1% truth-tellers), compared with genuine pleaders.

A MANOVA examining the effect of veracity on speech rate, word count, and proportion of speech hesitations during the direct appeal (Hypothesis 2) was significant at the multivariate level, $F(3, 48) = 3.11$, $p < .05$, partial $\eta^2 = .16$. Deceptive pleaders used fewer words ($M = 22.47$, $SD = 14.73$) than truth-tellers ($M = 45.44$, $SD = 38.47$) in their direct pleas, $F(1, 50) = 9.50$, $p < .01$, partial $\eta^2 = .16$. The MANOVA examining Hypothesis 3 provided partial support for the psychological distancing theory, $F(4, 47) = 5.03$, $p < .01$, partial $\eta^2 = .30$. Direct appeals by deceptive murderers also included a higher percentage of tentative words ($M = 13.94$, $SD = 9.50$), relative to genuine pleaders ($M = 5.45$, $SD = 6.16$), $F(1, 50) = 15.40$, $p < .001$, partial $\eta^2 = .24$. However, there were no differences in the percentage of pronouns and negative or positive emotional words across veracity, $p$s $> .05$. Again, several body language cues were too rare for meaningful statistical analyses to be performed; however, analyses examining proportion of gaze aversion and blink rate revealed a significant multivariate effect of veracity (Hypothesis 4), $F(2, 49) = 3.52$, $p < .05$, partial $\eta^2 = .13$. Although no follow-up univariate analyses were statistically significant, a trend emerged for deceptive pleaders ($M = 41.62$, $SD = 31.62$) to blink at a faster rate than genuinely distressed individuals ($M = 29.81$, $SD = 22.45$), $p = .13$.

## Multiple Cue Approach to Veracity Classification

To determine how a combination of cues could independently account for variance discriminating between deceptive killers and genuine pleaders, we conducted a direct binary logistic regression analysis with all four significant direct appeal cues (presence of upper face sadness and lower face happiness, word count, and percentage of tentative words) entered as predictors (Hypothesis 5; Vittinghoff & McCulloch, 2007).

A test of the full model, relative to a constant-only model, was statistically significant, $\chi^2(4, N = 52) = 31.58$, $p < .001$ (see Table 4 for statistics describing the contribution of each cue to the complete model). All of the predictors, less the presence of lower face happiness ($p = .06$), were statistically significant, $p$s $< .05$. In general, it appears that cues tapping emotional masking, cognitive load, and psychological distancing account for unique variance in the prediction of veracity, supporting Hypothesis 5. Further, classification was strong, with 92.3% of genuine and 88.5% of deceptive pleaders correctly classified (7.7% false positive rate; 11.5% false negative rate), for an overall success rate of 90.4%.

Table 4
*Logistic Regression Analysis of Veracity as a Function of Selected Verbal and Emotional Variables During the Direct Appeal*

| Predictor | β | Bootstrap 95% CI[a] Lower | Bootstrap 95% CI[a] Upper | Wald $\chi^2$ | OR |
|---|---|---|---|---|---|
| Upper face surprise | 2.52 | 0.76 | 18.86 | 6.90** | 12.49 |
| Lower face happiness | 1.56 | −0.25 | 10.16 | 3.31* | 4.76 |
| Tentative words | 0.14 | 0.05 | 0.81 | 6.13** | 1.15 |
| Word count | −0.04 | −0.32 | −0.01 | 4.37** | 0.96 |

[a] Bootstrapping was used to estimate 95% confidence intervals for each regression coefficient (Efron, 1979). In this method, random sampling with replacement was used to create 1,000 samples of the original size. The distribution of the regression coefficients across each of these resamples created an empirically derived sampling distribution to calculate 95% confidence intervals that assess the stability of parameters across alternative samples (Rodgers, 1999).
* $p = .06$. ** $p \leq .05$.

## Discussion

Undetected high-stakes deception can hold major consequences for individuals and society. Michael White of Canada was able to convince even his victim's mother when he made a tearful plea for the return of his pregnant wife; in reality, he brutally murdered her only days before. Bernard Madoff, who orchestrated the single largest fraud in history, is described by victims as seemingly "sincere" and "trustworthy." Psychopaths play the part of the rehabilitated, remorseful offender, manipulating their way into shorter sentences and earlier release than their nonpsychopathic counterparts (Hakkanen-Nyholm & Hare, 2009; Porter, ten Brinke, & Wilson, 2009). Building on a large body of literature describing behavioral cues to relatively mundane deception in laboratory settings, the present work offers a great leap forward in building our understanding of the (potentially uncontrollable) behavioral consequences of extremely high-stakes interpersonal deception. Indeed, it appears that involuntary facial and linguistic markers have the capacity to subtly reveal the darkest of secrets. This work also contributes in a significant way to our understanding of human communication more generally.

## Behavioral Differences in Complete Pleas

Over the course of the entire publicized plea, deceptive murderers were more likely to express disgust and less likely to express sadness than genuine pleaders (supporting Hypothesis 1). These pleas, occurring shortly after the relative's disappearance had been reported to the police, reveal the very different affective experiences of genuine and deceptive pleaders, even during unscripted and varied narratives. Throughout the plea, genuinely distressed innocent relatives displayed sincere, full-face sadness and distress, both reflecting their genuine emotion and potentially garnering the sympathy and assistance necessary to bring their loved one safely home (Eisenberg & Fabes, 1990). In contrast, the raised upper lip of disgust was more likely to occur during a deceptive plea. Although a facial expression cannot reveal its source, we speculate that disgust in this context indicates a visceral reaction to the act of murder that the deceptive pleader engaged in just days before, moral disgust or shame concerning one's actions, or a lingering revulsion for the victim (Chapman, Kim, Susskind, & Anderson, 2009; Ekman, 2003b). In addition to emotional differences, deceptive pleaders used more tentative words throughout the plea (partially supporting Hypothesis 3). In this way, deceptive murderers acknowledge that the victim will not be found alive, avoid commitment to the lie, and mitigate the psychological conflict resulting from the discrepancy between their secretly held and outwardly expressed knowledge (Zhou et al., 2004). However, no evidence

was found to support verbal indicators of cognitive load over the course of the entire appeal (Hypothesis 2). Further, no body language cues (potentially under careful control of the deceptive pleaders) differentiated complete genuine and deceptive pleas (Hypothesis 4).

## Cues to Deception in the Direct Appeals

The critical lies told by deceptive murderers occurred during the direct appeal—requesting help in the safe return of the missing person while harboring knowledge that this request would not be realized. It was generally anticipated that behavioral differences across veracity would be more salient during this portion of the plea than cues averaged across the complete plea, which includes variable content. Indeed, more hypotheses were supported during the direct appeal and larger effect sizes were obtained.

Related to Hypothesis 1, we expected that indices of unsuccessful emotional masking would be present. The predictive power of the presence of upper face surprise and lower face happiness highlights the relevance of contextually relevant, uncontrollable facial muscle actions in human emotional deception. The presence of upper face surprise in deceptive pleas is likely the result of failed attempts to portray sadness; liars can easily raise their eyebrows (i.e., contract their frontalis muscle, the primary muscle involved in the expression of surprise), but it is considerably more difficult to raise only the inner (and not the outer) frontalis, as is required for the simulation of grief in the forehead. Further, Darwin (1872) noted that the corrugator muscles, which pull the eyebrows together to create vertical wrinkles between the eyebrows and often are involved in the distress expression, are difficult to engage voluntarily (and in the absence of genuine emotion). The complementary prong of Darwin's inhibition hypothesis also was supported in the leakage of lower face happiness on the faces of deceptive pleaders. Possibly as a result of genuine satisfaction relating to the victim's demise or "nervous laughter," the presence of a smirk was a strong predictor of deception in this context. These findings are consistent with Hurley and Frank (2011), who found that liars could not completely inhibit eyebrow or lip corner movement despite instructions to do so during a mock crime interrogation.

Despite the credence bestowed on microexpressions as a cue to deception by the scientific and popular media communities, these brief emotional expressions occurred only rarely, even in such highly motivated and emotional deceptive pleas. Full-face, as well as upper or lower face, expressions lasting 1/25th to 1/5th of a second occurred approximately equally across genuine and deceptive direct appeals. Microexpressions in genuine appeals predominantly signaled sadness, potentially providing a cue to honesty. However, both genuine and deceptive appeals also included rare instances of briefly expressed happiness, disgust, and fear. In general, it appears that although microexpressions may signal genuine emotions (i.e., Ekman, 2006; ten Brinke, MacDonald, Porter, & O'Connor, 2011), the rarity with which they occur limits their potential as a cue to deceit. Fortunately for the lie detector, longer lasting emotional displays appear to be a more reliable signal of deception, one that may be combined with other behavioral cues to enhance the accuracy of credibility assessment.

The use of fewer words by deceptive pleaders, particularly during the direct appeal, reflects the increased cognitive load experienced by the liar or a strategy on the liar's part to provide few details to avoid an inconsistency in the future (Vrij et al., 2008). Again, deceptive pleaders used more tentative words than genuinely distressed individuals, supporting Hypothesis 3. Whereas genuine pleaders were confident and committed to the safe return of their missing loved one (e.g., Pam Poirier desperately pleading for her daughter's return: ". . . Katie please call us and tell us you're okay. Whoever took our Katie, please tell her we miss her, we love her, and we want her to come home . . ."; Radli, 1999), deceptive murderers used tentative words to (unconsciously) avoid commitment in their words to distance themselves from or subtly communicate knowledge of a transgression. For example, wife killer Michael White stated, "*If* whoever has her, *or if* she's out there and you see me, and you see this, just stay there, we'll find you. We will, I'll find you." White tells his (deceased) wife that *if* she sees this message (which he knows she will not), she should stay where she is and he will find her. It also is interesting to note that White indeed led a search party to his wife's body several days later (CTV News, 2006). Thus, while White plays the role of a distressed husband, his statements betray his knowledge of his wife's fate.

Lastly, speculation about the efficacy of body language cues was partially supported (Hypothesis 4). Although the use of illustrators and self-manipulators was rare, deceptive pleaders were able to maintain appropriate levels of eye contact. This finding is consistent with previous literature (e.g., DePaulo et al., 2003) using objective measures of eye contact (i.e., duration, proportion) and supports the proposition of Mann et al. (2011) that potential overzealousness in eye contact by the deceiver may only be captured by subjective observer ratings. Further, differential blink rate across pleader veracity approached significance; on average, deceptive pleaders blinked nearly twice as quickly as genuinely distressed individuals. This parallels experimental findings by Porter and ten Brinke (2008), who found that the arousal associated with masking emotion was associated with increased blink rate, and opposes the notion that cognitive load, alone, can account for changes in blink rate during deception (Leal & Vrij, 2010).

Theories of cognitive load, emotional falsification, and psychological distancing uniquely contributed to explaining behavioral differences between genuinely distressed pleaders and deceptive killers, supporting the proposition that reliance on a combination of behavioral channels is more effective than any single indicator (Porter & ten Brinke, 2010). Word count, tentative word use, and emotional cues (unsuccessful attempt to appear sad, leakage of happiness) each accounted for unique variance between genuine and deceptive pleaders. Although this model correctly classified credibility in 90% of cases, with a minimal false positive rate, further research is necessary to determine the predictive validity of these cues among different (and larger) samples, and to determine whether these cues indicate deception in other high-stakes contexts (see also Ekman, O'Sullivan, Friesen, & Scherer, 1991). For example, instances in which suspects deny knowledge of their transgression may also include a decreased number of words and leakage of genuine happiness related to their actions. However, failed attempts to appear distressed are unlikely to be relevant in this situation. In general, future research should examine behavioral consequences of deception in a variety of high-stakes settings, with a focus on uncontrollable (facial, linguistic) leakage.

## Implications

A consideration of the indicators examined here and the relative importance of each may serve as a guide for directing missing person or murder investigations in which there is reason to suspect a family member of foul play. Further, training legal and security staff to spot these and other empirically supported signals of covert, high-stakes information are likely to lead to increasingly accurate decision-making in contexts where lies can have life and death consequences. Recently, a group of psychologists was trained in the pitfalls and promises of deception detection. Specifically, the present findings were discussed at length and, using videos of the pleaders studied here, baseline and post-training deception detection accuracy was tested. The full-day training workshop led to dramatic posttraining gains (46.4% vs. 80.9%) associated with both an increased hit rate and decreased false alarm rate (Shaw, Porter, & ten Brinke, 2011). More generally, these findings begin to illuminate those behavioral cues that are prone to successful impression management (i.e., body language) and those that have the potential to indicate deception in highly motivated deceivers. These findings offer an important and novel advancement of our understanding of involuntary human communication.

## References


Bond, G. D., & Lee, A. Y. (2005). Language of lies in prison: Linguistic classification of prisoner's truthful and deceptive natural language. *Applied Cognitive Psychology, 19,* 313–329. doi:10.1002/acp.1087

Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009, September 2). In bad taste: Evidence for the oral origins of moral disgust. *Science, 323,* 1222–1226. doi:10.1126/science.1165565

CTV News. (2006). *Michael White found guilty of second-degree murder*. Retrieved from http://www.ctv.ca/CTVNews/CTVNewsAt11/20061207/michael_white_ 061207/

Darwin, C. (1872). *The expression of the emotions in man and animals.* Chicago, IL: University of Chicago Press.

DePaulo, B. M., & Kirkendol, S. E. (1989). The motivational impairment effect in the communication of deception. In J. C. Yuille (Ed.), *Credibility assessment* (pp. 51–70). Dordrecht, the Netherlands: Kluwer.

DePaulo, B., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to deception. *Psychological Bulletin, 129,* 74–118. doi:10.1037/0033-2909.129.1.74

Duchenne, G. B. (1862). *The mechanism of human facial expression.* New York, NY: Cambridge University Press.

Efron, B. (1979). Bootstrap methods: Another look at the jackknife. *Annals of Statistics, 7,* 1–26.

Eisenberg, N., & Fabes, R. A. (1990). Empathy: Conceptualization, measurement, and relation to prosocial behavior. *Motivation and Emotion, 14,* 131–149. doi:10.1007/BF00991640

Ekman, P. (2003a). Darwin, deception and facial expression. *Annals of the New York Academy of Sciences, 1000,* 205–221. doi:10.1196/annals.1280.010

Ekman, P. (2003b). *Emotions revealed: Recognizing faces and feelings to improve communication and emotional life.* New York, NY: Owl Books.

Ekman, P. (2006, October 29). How to spot a terrorist on the fly. *Washington Post.* Retrieved from http://www.washingtonpost.com

Ekman, P., & Friesen, W. V. (1969). Nonverbal leakage and clues to deception. *Psychiatry: Journal for the Study of Interpersonal Processes, 32,* 88–106.

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face: A guide to recognizing emotions from facial clues.* Englewood Cliffs, NJ: Prentice Hall.

Ekman, P., & Friesen, W. V. (1976). *Pictures of Facial Affect.* Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Friesen, W. V., & Hagar, J. C. (1976/2002). *Facial Action Coding System: The manual on CD-ROM.* Salt Lake City, UT: Network Information Research.

Ekman, P., Friesen, W. V., O'Sullivan, M., Chan, A., Diacoyanni-Tarlatzis, I., Heider, K., . . . Tzavaras, A. (1987). Universals and cultural differences in the judgment of facial expressions of emotion. *Journal of Personality and Social Psychology, 53,* 712–717.

Ekman, P., & O'Sullivan, M. (1991). Who can catch a liar? *American Psychologist, 46,* 913–920.

Ekman, P., O'Sullivan, M., Friesen, W. V., & Scherer, K. R. (1991). Invited article: Face, voice, and body in detecting deceit. *Journal of Nonverbal Behavior, 15,* 125–135. doi:10.1007/BF00998267

Hakkanen-Nyholm, H., & Hare, R. D. (2009). Psychopathy, homicide and the courts: Working the system. *Criminal Justice and Behavior, 36,* 761–777. doi:10.1177/0093854809336946

Harpster, T., Adams, S. H., & Jarvis, J. P. (2009). Analyzing 911 homicide calls for indicators of guilt or innocence: An exploratory analysis. *Homicide Studies, 13,* 69–93. doi:10.1177/1088767908328073

Hosmer, D. W., & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). New York, NY: Wiley.

Hurley, C. M., & Frank, M. G. (2011). Executing facial control during deception situations. *Journal of Nonverbal Behavior, 35,* 119–131. doi:10.1007/s10919-010-0102-1

Klaver, J., Lee, Z., & Hart, S. D. (2007). Psychopathy and nonverbal indicators of deception in offenders. *Law and Human Behavior, 31,* 337–351. doi:10.1007/s10979-006-9063-7

Krippendorff, K. (1980). *Content analysis: An introduction to its methodology.* Beverly Hills, CA: Sage.

Leal, S., & Vrij, A. (2010). The occurrence of eye blinks during a guilty knowledge test. *Psychology, Crime & Law, 16,* 349–357. doi:10.1080/10683160902776843

Livingstone Smith, D. (2004). *Why we lie: The evolutionary roots of deception and the unconscious mind.* New York, NY: St. Martin's Press.

Mann, S., Vrij, A., & Bull, R. (2002). Suspects, lies and videotape: An analysis of authentic high-stakes liars. *Law and Human Behavior, 26,* 365–376. doi:10.1023/A:1015332606792

Mann, S., Vrij, A., Leal, S., Granhag, P. A., Warmelink, L., & Forrester, D. (2011). *Look into my eyes: Deliberate eye contact as a cue to deceit.* Manuscript submitted for publication.

Newman, M. L., Pennebaker, J. W., Berry, D. S., & Richards, J. M. (2003). Lying words: Predicting deception from linguistic style. *Personality and Social Psychology Bulletin,* 29, 665–675. doi:10.1177/0146167203029005010

Pennebaker, J. W., Francis, M. E., & Booth, R. J. (2001). *Linguistic inquiry and word count (LIWC): LIWC 2001.* Mahwah, NJ: Erlbaum.

Porter, S., Doucette, N., Earle, J., & MacNeil, B. (2008). "Halfe the world knowes not how the other halfe lies": Investigation of cues to deception exhibited by criminal offenders and non-offenders. *Legal and Criminological Psychology, 13,* 27–38. doi:10.1348/135532507X186653

Porter, S., & ten Brinke, L. (2008). Reading between the lies: Identifying concealed and falsified emotions in universal facial expressions. *Psychological Science, 19,* 508–514. doi:10.1111/j.1467-9280.2008.02116.x

Porter, S., & ten Brinke, L. (2010). The truth about lies: What works in detecting high-stakes deception? *Legal and Criminological Psychology, 15,* 57–75. doi:10.1348/135532509X433151

Porter, S., ten Brinke, L., & Wallace, B. (in press). Secrets and lies: Involuntary leakage in deceptive facial expressions as a function of emotional intensity. *Journal of Nonverbal Behavior.*

Porter, S., ten Brinke, L., & Wilson, K. (2009). Crime profiles and conditional release performance of psychopathic and non-psychopathic

sexual offenders. *Legal and Criminological Psychology, 14,* 109–118. doi:10.1348/135532508X284310

Radli, A. (1999, September 9). *Blom confesses to killing Katie Poirier*. Retrieved from http://news.minnesota.publicradio.org/features/199909/09_radila_poirier/

Rodgers, J. L. (1999). The bootstrap, the jackknife, and the randomization test: A sampling taxonomy. *Multivariate Behavioral Research, 34,* 441–456. doi:10.1207/S15327906MBR3404_2

Shaw, J., Porter, S., & ten Brinke, L. (2011). *Catching liars: Training mental health and legal professionals to detect extremely high-stakes lies.* Manuscript submitted for publication.

Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology, 29,* 24–54. doi:10.1177/0261927X09351676

ten Brinke, L., MacDonald, S., Porter, S., & O'Connor, B. (2011). Crocodile tears: Facial, verbal and body language behavior associated with genuine and fabricated remorse. *Law and Human Behavior.* Advance online publication. doi:10.1007/s10979-011-9265-5

ten Brinke, L., Porter, S., & Baker, A. (2011). *The indelible stamp of deceit: Facial muscles reveal emotional high-stakes lies*. Manuscript submitted for publication.

Vittinghoff, E., & McCulloch, C. E. (2007). Relaxing the rule of ten events per variable in logistic and Cox regression. *American Journal of Epidemiology, 165,* 710–718. doi:10.1093/aje/kwk052

Vrij, A. (2005). Criteria-based content analysis: A qualitative review of the first 37 studies. *Psychology, Crime & Law, 11,* 3–41. doi:10.1037/1076-8971.11.1.3

Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities.* Chichester, England: Wiley.

Vrij, A., Granhag, P. A., & Porter, S. (2011). Pitfalls and opportunities in nonverbal and verbal lie detection. *Psychological Science in the Public Interest, 11,* 89–121.

Vrij, A., & Mann, S. (2001a). Telling and detecting lies in a high-stake situation: The case of a convicted murderer. *Applied Cognitive Psychology, 15,* 187–203. doi:10.1002/1099-0720(200103/04)15:2<187::AID-ACP696>3.0.CO;2-A

Vrij, A., & Mann, S. (2001b). Who killed my relative? Police officers' ability to detect real-life high-stake lies. *Psychology, Crime & Law, 7,* 119–132. doi:10.1080/10683160108401791

Vrij, A., Mann, S., Fisher, R., Leal, S., Milne, B., & Bull, R. (2008). Increasing cognitive load to facilitate lie detection: The benefit of recalling an event in reverse order. *Law and Human Behavior, 32,* 253–265. doi:10.1007/s10979-007-9103-y

Weinberger, S. (2010, May 26). Airport security: Intent to deceive? *Nature, 465,* 412–415. doi:10.1038/465412a

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 and Negotiation, 13,* 81–106. doi:10.1023/B:GRUP.0000011944.62889.6f

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## Correction to Levenson, Sandler, and Freeman (2012)

The article "Failure-to-Register Laws and Public Safety: An Examination of Risk Factors and Sex Offense Recidivism" by Jill S. Levenson, Jeffrey C. Sandler, and Naomi J. Freeman (*Law and Human Behavior*, Advance online publication. April 2, 2012. doi: 10.1037/b0000002), should have included the following disclosure statement.

"Data for this project were furnished to the researchers by the New York State Division of Criminal Justice Services (DCJS). However, DCJS was not responsible for the methods of statistical analysis or the conclusions reached. Any opinions and suggestions within the paper are those of the authors alone, and not representative of the views of DCJS or the NYS Office of Mental Health. Neither New York State nor DCJS assumes liability for its contents or use thereof."

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