

Crocodile Tears: Facial, Verbal and Body Language Behaviours Associated with Genuine and Fabricated Remorse

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Abstract Emotional deception is a common behaviour that can have major consequences if undetected. For example, the sincerity of an offender's expressed remorse is an important factor in sentencing and parole hearings. The present study was the first to investigate the nature of true and false remorse. We examined facial, verbal and body language behaviours associated with emotional deception in videotaped accounts of true personal transgressions accompanied by either genuine or falsified remorse. Analyses of nearly 300,000 frames indicated that descriptions of falsified remorse were associated with a greater *range* of emotional expressions. Further, sequential analyses revealed that negative emotions were more commonly followed by other emotions—rather than a return to neutral emotion—in falsified versus sincere remorse. Participants also exhibited more speech hesitations while expressing deceptive relative to genuine remorse. In general, the results suggest that falsified remorse may be conceived as an emotionally turbulent display of deliberate, falsified expressions and involuntary, genuine, emotional leakage. These findings are relevant to judges and parole board members who consider *genuine* remorse to be an important factor in sentencing and release decisions.

Deception is a common aspect of human social interaction. People admit to using deceit in 14% of emails, 27% of face-to-face interactions and 37% of phone calls (Hancock,

2007), and lie twice a day, on average (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). While these acts of deception typically are minor, white lies of little consequence (DePaulo et al., 1996), lies accompanied by powerful emotions and false emotional displays can have major consequences at individual and societal levels. For example, in sentencing and parole hearings, the presence of remorse is a major factor in decision-making; the perceived credibility of a defendant's emotion during his/her testimony inform ultimate decisions pertaining to their future. In the absence of genuine remorse, an offender may be highly motivated to fake regret for his/her actions, and the judge, jury or parole board member may be similarly motivated to detect "crocodile tears". In sentencing decisions, judges are instructed to consider "the age of the victim, the duration and frequency of the [crimes], the criminal record of the offender, the effects on the victim and the presence or absence of ... remorse" (*R. v. B.*, 1990; *R. v. W.W.M.*, 2006). In evaluating remorse, judges often refer to the defendant's demeanour: "The appellant's responses to questions posed him and his demeanour showed that his main concern was for himself... I would have expected some show of distress or anguish for having raped a previously chaste young woman. The appellant showed no such signs" (*Balkissoon v. Canada (Citizenship and Immigration)*, 2001). On the other hand, defendants who portray remorse for their actions are considered to be good candidates for treatment and rehabilitation: "[The defendant's] remorse, guilt, and shame should provide him with a strong motivation to work at changes that will prevent future acts of violence" (*R. v. Struve*, 2007). It is clear that impressions of remorse, based on demeanour, can influence the length of an offender's sentence.

Apparent level of remorse also is an important consideration when an offender is eligible for release upon parole.

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A primary purpose of a parole interview is to provide the offender with the opportunity to show the parole board that his/her attitude has changed since he/she first arrived in prison (Ruback & Hopper, 1986). If an offender displays remorse during the interview, parole board members may take this as a positive indication that the offender is prepared for reintegration into the community. However, it is clear that many decisions are not well informed and risky releases can occur when offenders manipulate parole decision-makers. Ruback and Hopper (1986) investigated judgments made by parole board members regarding the offenders' success on parole both before and after an interview with the parole candidates. Before the interview, the board members had access to the offenders' files, detailing all relevant information required to make a decision regarding the offenders' release. During the interview, parole board members gained information concerning the offender's attitude and apparent level of remorse. Results indicated that decisions made by board members became *less* accurate in predicting offenders' success upon subsequent release, relative to their judgments based on file information alone. Interestingly, this indicates that the face-to-face contact with the offender impaired the parole officers' judgments, such that high-risk offenders were more often released. Similarly, Porter, ten Brinke, and Wilson (2009) explored the probability of offenders' release as a function of their level of psychopathy. Psychopathic offenders, known for their remorselessness and ability to charm and manipulate others, were approximately 2.5 times more likely to be granted conditional release compared to non-psychopaths. As with Ruback and Hopper's (1986) findings, one explanation is that the decision-makers were duped by offenders during their interviews, persuaded by false displays of remorse.

But what is remorse? Most of us—barring psychopaths—feel remorseful for something we have done to another person (e.g. cheating on our partner, lying to our parents). Yet, there has been hardly any psychological research on the manifestation of emotional facial expressions during this common human experience (cf. Keltner & Buswell, 1996). Remorse, or guilt, is defined as the negative feeling resulting from the violation of one's moral standards, and may arise from situations such as lying, neglecting a friend or family member, cheating, or failure at a particular duty (Keltner & Buswell, 1996; Tangney & Dearing, 2002). Feelings of guilt occur particularly in situations where the regrettable action was controllable by the transgressor (Tracy & Robins, 2006). Although Izard (1977) and Keltner & Buswell (1996) suggest that a single universal expression does not represent remorse, no empirical investigations to date have considered examining the combination of universal emotional expressions associated with this affective state. Further, no studies have

examined the potential emotional expression differences between genuine and fabricated remorse, reflecting the paucity of research surrounding colloquial ideas about emotional deception more generally (Porter & ten Brinke, 2010). The issue of whether “crocodile tears” are identifiable has received no empirical attention.

Theory and research suggest that various behavioural cues associated with deception do exist (see Porter & ten Brinke, 2010). In theory, the presentation of liars and truth-tellers should differ because of the elevated arousal, cognitive load and behavioural control involved in fabricating a personal account or feelings (Vrij, 2008). The liar is forced to avoid betraying the deception by controlling his/her feelings of guilt or excitement, monitoring his/her words and keeping the story straight, while supplying sufficient detail to appear credible but not so much as to lead to a failure in recalling and maintaining the falsified details. While telling the story, the liar must monitor his/her facial expressions (sometimes having to conceal or falsify an emotion) and body language. This necessary “multi-tasking” should reduce the level of conscious control the liar has over each behavioural channel, and increase the amount of relative “leakage” from one or the other(s), depending on the where he/she is devoting relative degrees of effort (Porter & ten Brinke, 2010).

Facial Cues to Emotional Deception

Given that the face is the primary focus during interpersonal interaction, a wise liar might devote particular attention to controlling his/her facial expression. We rapidly “read” faces to decide whether a stranger is friend or foe, make personality assessments, and inform the course of our interactions (Fowler, Lilienfeld & Patrick, 2009; ten Brinke & Porter, 2009; Willis & Todorov, 2006). Thus, deceptive individuals must maintain their duplicity by falsifying emotional expressions concordant with the lie, and suppressing “leakage” of their true emotions (Ekman & Friesen, 1975). For example, a deceptive employee must convincingly express sadness as he explains to his boss that he will need to miss work to attend his aunt's funeral out of town, simultaneously suppressing excitement about his real plans to extend a vacation with friends. Given the complex musculature of the face, and the heavy cognitive load associated with such a task, it is not surprising that expression of genuine and falsified emotions can be perceptibly different.

False facial expressions were first studied in the nineteenth century by Duchenne (1862/1990) who examined the muscle actions associated with real and false smiles. Using electrical stimulation of facial muscles, he noted that a genuine happiness expression involves not only the

contraction of the *zygomatic major* muscle which upturns the mouth corners into a smile, but also the *orbicularis oculi* which creates crow's feet around the eye. This observation was later validated by Ekman, Davidson, and Friesen (1990). A follower of Duchenne's work, Darwin (1872) later noted: "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" (p. 79). He proposed that some facial actions associated with strong emotion cannot be inhibited voluntarily and that the same muscle actions cannot be engaged voluntarily during emotional simulation. Implicit in this statement is the suggestion that leakage of one's true emotion will be proportional to the intensity of the felt emotion. Collectively, these statements form the *inhibition hypothesis* (Ekman, 2003a). Micro-expressions—a derivation of Darwin's idea—are defined as short-lived leakage of one's true emotion manifested as an emotional expression lasting 1/25th to 1/5th of a second (Ekman, 1992; see also Haggard & Isaacs, 1966). Despite the popularity of both Darwin's and Ekman's hypotheses, little research has been conducted to substantiate these ideas.

In a direct examination of Darwin's (1872) hypothesis, Porter and ten Brinke (2008) investigated the nature of facial expressions accompanying four types of falsified or concealed universal emotions: happiness, sadness, fear and disgust. Participants viewed powerful emotional images, responding with a genuine or convincing but false expression while being judged by a naïve observer. False expressions, in response to emotionally provocative images were either simulated (an unfeared emotion was expressed) or masked (a false expression replaced that of the felt emotion). When the 697 videotaped expressions were exhaustively analyzed (each 1/30th second frame for more than 100,000 frames), involuntary leakage was found to be ubiquitous. No participant was able to falsify each emotion without such betrayals on at least one occasion. Emotional leakage was significantly more likely to occur, and lasted longer, in masked expressions than genuine. However, the presence and duration of emotional leakage were not significantly different across genuine and simulated emotional expressions. In general, negative emotions (sadness, fear, disgust) were more difficult to falsify than positive (happiness), and resulted in greater emotional leakage. Despite the presence of these indicators, naïve judges performed only slightly above chance when attempting to discriminate genuine and falsified expressions (see also Hess & Kleck, 1994). Previous studies also have found differences in the duration, onset, and offset times between genuine and false expressions of happiness and disgust (e.g. Frank, Ekman, & Friesen, 2005; Hess & Kleck, 1990). Although no research to date has examined potential sequential differences in

genuine versus deceptive emotional displays, it may be inferred that emotions related to the act of deception could follow falsified expressions. For example, Ekman (1992) noted that deceivers might not anticipate the intensity of emotions related to the act of lying, resulting in signs of shame or duping delight on the face following falsified emotions.

Verbal and Body Language Cues to Deception

Empirical evidence suggests that there may be value in attending to verbal cues in catching emotional lies such as remorse narratives (e.g. Porter & Yuille, 1995; Vrij, 2008). The broad deception literature suggests that, relative to truth-tellers, liars are more likely to speak slower and provide less detail (DePaulo et al., 2003; Porter, Yuille, & Lehman, 1999). Liars also are more likely to hesitate, including more 'ums' and 'ers' in their stories relative to genuine individuals (DePaulo et al., 2003; Vrij, 2008). Further, linguistic patterns can provide indications of dishonest speech (Hancock, Curry, Goorha, & Woodworth, 2008). Research in which participants wrote about their views on personally significant topics (e.g. abortion) indicated that deceptive and truthful narratives were discriminated with a mean accuracy of 67% based on linguistic characteristics alone (Newman, Pennebaker, Berry, & Richards, 2003). Specifically, liars tended to use fewer first-person pronouns and references to others.

The existing literature substantiates that there also are associations between body language and deception. In their meta-analysis, DePaulo et al. (2003) found that a reduction in illustrator use was among the most powerful indicators of deception. Other empirically supported indicators include an increase in self-manipulations and blink rate (specifically during emotional masking) (Porter, Doucette, Earle, & MacNeil, 2008; Porter & ten Brinke, 2008). While gaze aversion is widely regarded as a reliable cue to deceit, it has not found empirical support (Global Deception Research Team, 2006). In fact, the opposite may be true; liars may make greater eye contact than truth-tellers in a conscious attempt to appear convincing (Vrij, 2008).

The Present Study

The present study investigated potential facial, verbal and body language cues to deception in descriptions of true autobiographical transgressions associated with genuine and falsified remorse. Differences in the presence and duration of emotional expressions were expected to occur when participants described their genuine versus their deceptive feelings of remorse (i.e. when participants said, "I felt really guilty", or something similar).

Hypothesis 1 The *presence* of sadness was expected to dominate genuine, relative to deceptive descriptions of feelings. Deceptive descriptions of felt emotion, on the other hand, were expected to be characterized by the *presence* of various discordant emotional expressions, such as happiness or anger.

Hypothesis 2 Similarly, genuine emotional descriptions were expected to be accompanied by longer *durations* of sadness, whereas deceptive descriptions would include longer *durations* of happiness and anger.

Such differences were not expected when emotional presence and duration were collated across the entirety of each event description because most of each falsified remorse narrative was comprised of truthful event details. Further, we examined the presence of micro-expressions (Ekman, 1992) as a potential cue to emotional deceit, but refrained from posing a hypothesis.

We also suspected that the *sequences* of facial expressions that individuals display when they are being deceptive might differ from the naturally occurring sequences of facial expressions that occur during genuine remorse. The duping delight, embarrassment or urge to express one's genuine emotions may result in (genuine) discordant emotions following (falsified) sadness expressions. To our knowledge, this possibility has not been examined in previous research. We therefore conducted sequential analyses on the facial expressions data.

Hypothesis 3 It was expected that (falsified) negative expressions would be more often followed by positive expressions (emotional leakage) during false remorse, compared to genuine regret.

In addition to emotional facial variables, verbal and non-verbal cues to deception were examined.

Hypothesis 4 Verbal indicators, including slowed speech rate, increased speech hesitations, and fewer self- and other-references, were expected to be associated with deceptive remorse.

Hypothesis 5 Various body language behaviours (decreased use of illustrators, increased use of self-manipulators, increased blink rate and potentially, decreased gaze aversion) were examined as cues to falsified remorse.

Method

Participants

Undergraduate students ($N = 31$) in a Canadian university participated in return for course credit points. Participants

were 20 females and 11 males and had a mean age of 21.67 ($SD = 4.34$). Three additional naïve, undergraduate research assistants judged the veracity of participant displays of remorse. The presence of an observer was intended primarily to increase the realism of the task and the motivation of the participant.

Apparatus

The testing room was arranged such that the participant was seated in a chair facing video-recording equipment. Two digital video cameras, recording at a rate of 30 frames per second, were used to film the participant, capturing footage of the participant's entire body and a close-up of the participant's face, respectively. The experimenter and a naïve judge were seated on either side (left and right) of the video camera, facing the participant.

Procedure

Upon arriving for the study, all participants and judges completed an informed consent form and were provided with a definition of remorse, as well as common situations associated with this emotion, as outlined by Keltner and Buswell (1996). Participants were asked to tell the experimenter about a true non-criminal event in their life that made them feel intensely and genuinely remorseful, in as much detail as possible. Subsequently, the participants were asked to complete a filler-task questionnaire and a short demographic survey (age, gender, ethnicity and education level). Participants also were asked to describe a similar true event (counterbalanced order) for which they felt no/little remorse, but were asked to convincingly feign remorse for their actions. For example, if the participant described an instance of cheating for which he/she genuinely felt remorseful, he/she was asked to think of another time he/she cheated but did not feel remorseful to describe with falsified remorse. Participants were told to choose events that occurred within 6 months of one another to reduce differential effects of memory decay or emotional intensity on narratives. Subsequently, participants were asked to indicate their level of remorse for each transgression on a scale from 1 (not at all remorseful) to 7 (highly remorseful). This served as a manipulation check to ensure the two autobiographical events were indeed associated with different levels of felt remorse. Naïve judges estimated the veracity of remorse in each description (genuine or falsified) and rated their confidence in that decision. The presence of a naïve judge during recording acted as social motivation, encouraging participants to act convincingly remorseful. At the completion of the study, all participants were fully debriefed about its purposes.

Coding Procedures

Blind (to veracity) coding was conducted for all facial, verbal and body language variables. Emotional facial expressions occurring during each narrative were coded using the procedure developed by Porter and ten Brinke (2008). Training involves facial musculature recognition, memorization of facial action units associated with universal emotions, and identification of universal emotions. This training is based on the Pictures of Facial Affect (universal emotions depicted in photographs; Ekman & Friesen, 1976) and the Facial Action Coding System (Ekman, Friesen, & Hagar, 2002). See Porter and ten Brinke (2008) for further information on coding procedures and training. Each frame (1/30th of a second) of the narratives was coded for the presence, duration and sequence of universal emotional expressions in the upper and lower portion of the face independently. Universal emotions include happiness, sadness, fear, disgust, anger, surprise and the relatively recent addition of contempt (Ekman & Friesen, 1975; Ekman et al., 1987). A primary (graduate student) coder, blind to veracity condition, examined all narratives. In order to examine emotion in the upper and lower face separately, all 149,331 frames were coded twice (once with attention to the upper face, and again for the lower) for a total of 298,662 analyzed frames.

Body language variables examined included: rate of illustrators, rate of self-manipulations, proportion of time spent averting gaze and blink rate. Illustrators were defined as any movement/gesture of the arms and/or hands, designed to illustrate what the participant was saying. Self-manipulations were any instance where the participant touched/scratched his/her hand, head or body (Porter et al., 2008). Verbal variables coded included: speech rate, rate of speech hesitations (e.g. the use of “um” or “uh”, etc.), proportion of self-references (e.g. “I”, “we”, “my”) and proportion of reference to others (e.g. “him”, “she”, “they”).

Coding Reliability

Facial Emotion Variables. Sixteen (26%) of the narratives were independently coded by a second individual (a trained undergraduate, blind to veracity and hypotheses) to assess inter-rater reliability. The raters agreed on emotion codes for 84.07% of the 48,071 frames that were coded for the purposes of reliability. The duration (measured in number of frames) of emotional expressions, as coded by the two individuals, were correlated at $r(248) = .99$, $p < .001$. Further, no mean difference between raters was revealed, $p > .05$. Inter-rater reliability on the duration variable was “excellent”, as defined by Cicchetti and Sparrow (1981) and Fleiss (1981).

Agreement on the dichotomously coded presence/absence of emotional expressions also was high, $Kappa = .70$, $p < .001$, with agreement on 87.90% of all codes.

Verbal and Non-Verbal Variables. A secondary coder re-examined 14 (23%) of the narratives for verbal and non-verbal cues to assess inter-rater reliability. Verbal and non-verbal variables coded by the primary and secondary coder were highly correlated, $r = 0.60\text{--}0.99$, $ps < .05$. Further, means were not significantly different between coders, all $ps > .05$. Inter-rater reliability was at least “good”, and more often “excellent” (as defined by Cicchetti & Sparrow (1981) and Fleiss (1981)) on all indices.

Results

Manipulation Check

To ensure that each narrative was associated with different levels of remorse (e.g. high remorse in the genuine condition and low remorse in the fabricated condition), a paired samples *t*-test was conducted for the participant ratings of each narrative. As expected, participants reported significantly more remorse for their genuine ($M = 6.09$, $SD = 0.65$) than fabricated ($M = 2.06$, $SD = 0.77$) remorse event, $t(30) = 24.61$, $p < .001$, $d = 6.29$, 95% CI [3.70, 4.37].

Facial Cues to Falsified Remorse

Descriptions of Felt Emotions. Although the narratives were unstructured, the majority of participants included a description of felt emotions associated with the event (e.g. “I felt so bad”; “I felt really guilty”). Of the 31 participants, $n = 23$ included such a statement in both of their (genuine and falsified) descriptions of remorse. In order to test Hypotheses 1 and 2, the start and end times of these descriptions were noted, and emotional facial variables occurring within these sections were calculated. Specifically, the presence/absence, as well as the total duration, of each universal emotion served as dependent variables in subsequent analyses.

Hypothesis 1 The Generalized Linear Equations procedure in SPSS was used to conduct a repeated measures logistic regression for the prediction of the presence/absence of emotions. The durations of the descriptions and the participant ratings of remorse served as covariates. There was a significant effect for veracity (genuine vs. falsified remorse), Wald Chi-Square = 117.1, $p < .001$. More of the seven universal emotions were likely to be

present during descriptions of falsified remorse ($M = .95$, $SE = .02$), relative to genuine remorse ($M = .73$, $SE = .06$). There were also effects for facial hemisphere (upper vs. lower face), and emotion (happiness, sadness, fear disgust, anger, surprise and contempt), including interactions. However, these effects are not relevant to our hypotheses and thus, are not reported here. See Table 1 for descriptive statistics.

Hypothesis 2 The MIXED procedure in SPSS was used to examine the effects of credibility on the duration of universal emotional expressions during descriptions of remorse. The durations of the descriptions and the participant ratings of remorse once again served as covariates. However, there were no significant effects involving credibility, $ps > .05$.

Complete Description of Event. A series of SPSS MIXED model analyses was then conducted, to reveal potential differences in facial emotion behaviour over the entirety of the narratives. Veracity (genuine vs. falsified remorse), facial hemisphere (upper vs. lower face) and emotion (each of the seven universal emotions) were the within-subjects factors. The durations of the narrative and the participant ratings of remorse served as covariates. In separate analyses, the presence/absence and total duration (number of 1/30th second frames) of each of the seven universal emotions served as dependent variables. No

significant main effects or interactions involving veracity emerged, $ps > .05$, suggesting that emotional deception was restricted to descriptions of emotion, specifically, as we hypothesized.

Micro-expressions. Based on the definition of micro-expressions offered by Ekman (1992), emotional expressions lasting one-fifth of a second or less occurring in the upper or lower face were isolated for further analysis. A total of 23 micro-expressions were detected, including 12 upper face and 11 lower face expressions. These affective displays were produced by 10 (32.3%) participants and occurred in 12 (19.4%) of the 62 narratives. Upper face micro-expressions in the fabricated condition were predominantly of anger (5 of 9 micro-expressions) while the majority of lower face micro-expressions were displays of sadness (6 of 8 micro-expressions; refer to Table 2).

Sequential Analyses of Facial Expressions. Sequential analyses and follow-up loglinear analyses were conducted to test *Hypothesis 3* and gain a more detailed understanding of the emotional processes involved in falsified remorse. In sequential analysis, a stream of codes (in this case, the series of 905 codes for facial expressions) are read to produce a transitional frequency matrix, which is simply a table of frequency counts for the number of times each code was followed by other codes in the coding system. To simplify

Table 1 Descriptive statistics of facial expression variables during the descriptions of felt emotions

	Genuine		Deceptive	
	Mean (<i>SD</i>) duration in frames	Presence (% of narratives)	Mean (<i>SD</i>) duration in frames	Presence (% of narratives)
Upper face				
Happy	12.2 (23.8)	30.4	9.7 (18.5)	27.3
Sad	2.0 (9.4)	4.3	8.6 (24.5)	18.2
Fear	4.0 (19.2)	4.3	1.6 (7.5)	4.5
Disgust	0.0 (0.0)	0.0	.6 (2.8)	4.5
Anger	0.4 (1.9)	4.3	5.6 (22.5)	9.1
Surprise	7.1 (16.2)	26.1	9.1 (16.2)	31.8
Contempt	0.0 (0.0)	0.0	.4 (1.7)	4.5
Neutral	40.4 (28.6)	82.6	36.4 (30.2)	81.8
Lower face				
Happy	21.0 (26.0)	47.8	28.6 (40.2)	59.1
Sad	1.4 (6.3)	8.7	4.0 (18.8)	4.5
Fear	0.0 (0.0)	0.0	0.0 (0.0)	0.0
Disgust	0.0 (0.0)	0.0	.5 (2.1)	4.5
Anger	0.0 (0.0)	0.0	0.0 (0.0)	0.0
Surprise	0.0 (0.0)	0.0	0.0 (0.0)	0.0
Contempt	0.0 (0.0)	0.0	0.0 (0.0)	0.0
Neutral	43.6 (43.6)	65.2	39.0 (30.2)	72.7

Table 2 Frequency of emotional micro-expressions revealed by the upper and lower face during complete descriptions of genuine and fabricated remorse

	Genuine	Fabricated
Upper face		
Total	3	9
Happy	0	1
Sad	0	0
Fear	0	1
Disgust	0	1
Anger	1	5
Surprise	1	1
Contempt	1	0
Lower face		
Total	8	3
Happy	1	1
Sad	6	1
Fear	0	1
Disgust	0	0
Anger	0	0
Surprise	0	0
Contempt	1	0

the analyses and to avoid dealing with large, transitional frequency matrices, the facial emotion codes were collapsed into three groups based on emotional valence: positive (happiness), negative (sadness, fear, anger, contempt) or neutral (neutral, surprise). Surprise was included in the “neutral” valence category because it is not easily characterized as positive or negative. It should be noted, however, that while surprise did (rarely) occur in the upper face, it never appeared in the lower face. Thus, the “neutral” category in lower face sequential and loglinear analyses are comprised of purely neutral expressions despite the inclusion of surprise in this category. The software provided by O’Connor (1999) was used to obtain four separate transitional frequency matrices: (1) for the genuine upper face, (2) for the genuine lower face, (3) for the deceptive upper face and (4) for the deceptive lower face. Loglinear analyses were then conducted to determine whether the transitional frequencies varied across the genuine and deceptive conditions. The transitional frequencies appear in Table 3, and the corresponding standardized residuals (*z* values) for each cell are provided in Table 4.

For the upper face data, a hierarchical loglinear analysis with backward elimination resulted in a model in which only the Lag 0 to Lag 1 (antecedent-to-consequent) term remained significant, $\chi^2(4) = 16.5, p < .001$. None of the terms involving veracity were significant predictors of the

Table 3 Frequencies of antecedent–consequent transitions in facial emotions

Antecedent	Consequent	Lower face		Upper face	
		Genuine	Fabricated	Genuine	Fabricated
Positive	Positive	0	0	0	0
Positive	Negative	14	27	15	16
Positive	Neutral	146	125	98	88
Negative	Positive	11	25	18	24
Negative	Negative	0	7	4	7
Negative	Neutral	66	45	90	94
Neutral	Positive	158	137	99	92
Neutral	Negative	65	44	93	103
Neutral	Neutral	14	16	269	211

Note: Positive–positive transitions are structural zeros (i.e. zero by definition). Given that only happiness was included in the positive valence group, there was no opportunity for one positive emotion to follow another

transitional frequencies. These findings indicate that while there were significant antecedent-to-consequent transitions, the patterns of transitional frequencies for upper facial emotions were the same (i.e. not significantly different) across the genuine and deceptive conditions.

For the lower face data, a hierarchical loglinear analysis revealed that elimination of the three-way interaction term (veracity \times antecedent \times consequent) resulted in a significant reduction in fit relative to the saturated model, $\chi^2(4) = 16.8, p = .002$. This means that the transitional frequencies varied depending on veracity. To explore the interaction, loglinear analyses were conducted within the genuine and falsified remorse conditions and the standardized residuals from these analyses are provided in Table 4.

Table 4 Standardized residuals for antecedent-consequent transitions in emotional facial expressions

Antecedent	Consequent	Lower face		Upper face	
		Genuine	Fabricated	Genuine	Fabricated
Positive	Positive	0	0	0	0
Positive	Negative	-4.26	-2.67	-1.54	-1.84
Positive	Neutral	2.52	1.73	.76	1.04
Negative	Positive	-4.73	-3.04	-1.02	-.63
Negative	Negative	-3.04	-.76	-3.23	-3.43
Negative	Neutral	7.72	4.85	2.18	2.33
Neutral	Positive	2.70	1.90	.50	.35
Neutral	Negative	6.88	4.14	2.45	2.96
Neutral	Neutral	-7.45	-5.41	-1.50	-1.89

Note: $p < .05$ for standardized residuals >1.96 or <-1.96 . Positive–positive transitions are structural zeros (i.e. zero by definition)

The patterns in the standardized residuals are easily summarized. Almost all of the lower face transitions were significant, whereas few of the upper face transitions reached significance. The same basic trends nevertheless existed in the transitions for the upper and lower face. The directions of the lower face transitions were simply stronger, or amplified. There is also a distinct pattern in the transitions, which is perhaps most easily discerned by focusing on the left-most column of numbers in Table 4, which are the standardized residuals for the genuine condition. The pattern has three components: (1) transitions from positive to negative facial emotions, and from negative to positive facial emotions, are notably rare; (2) transitions from neutral emotions to positive and negative emotions are common and (3) transitions from positive to neutral emotions, and from negative to neutral emotions, are also common. In other words, genuine participants did not display rapid or immediate transitions between positive and negative emotions, and their transitions in and out of positive and negative emotions involved, or occurred through, neutral emotions. This same three-component pattern also occurred in deceptive remorse, but it was less pronounced. Deception involved relatively more frequent direct transitions between positive and negative emotions, and relatively fewer indirect sequences via neutral emotions.

Verbal and Body Language Cues to Falsified Remorse

Hypothesis 4 A repeated-measures MANOVA with veracity (genuine vs. falsified remorse) as the within-participant factor was conducted with speech rate, rate of speech hesitations, proportion of self references, and proportion of other references as dependent variables. This analysis revealed a significant multivariate effect of veracity, $F(4, 26) = 2.84$, $p = .045$, $\eta^2 = 0.10$. Follow-up univariate analyses revealed that participants exhibited a significantly higher rate of speech hesitations during fabricated remorse ($M = 0.06$, $SD = 0.05$) compared to genuine remorse ($M = 0.04$, $SD = 0.04$), $F(1, 29) = 5.21$, $p = .03$, $\eta^2 = 0.15$, 95% CI [0.002, 0.029]. It also is noteworthy that a second variable approached significance. Participants mentioned more references to other people while displaying fabricated remorse ($M = 0.07$, $SD = 0.03$) relative to genuine remorse ($M = 0.05$, $SD = 0.02$), $F(1, 29) = 3.53$, $p = .07$, $\eta^2 = 0.11$, 95% CI [-0.001, 0.029].

Hypothesis 5 A repeated-measures MANOVA with veracity (genuine vs. falsified remorse) as the within-participant factor was conducted with rate of illustrators, proportion of time spent averting gaze, and blink rate as the dependent variables. The multivariate effect of veracity was non-significant, $F(3, 27) = 0.47$, $p = .71$.

Discussion

Feeling remorse is a basic and common human affective experience, often occurring in response to a personal failure or transgression (Keltner & Buswell, 1996). Despite the potential implications of falsifying these feelings in forensic settings, there has been hardly any research on the subject. To our knowledge, the present study was the first to investigate genuine and falsified remorse for behavioural cues that might be indicative of such deception. It was expected that emotional presentations would differ across levels of credibility specifically when participants described their feelings associated with each transgression.

Emotional Facial Cues to Falsified Remorse

Description of Felt Emotion. One major finding was that there were significant differences in the presence of universal emotional facial expressions across real and false remorse. Falsified descriptions of remorseful feelings (e.g. "I felt so guilty") were associated with the presence of a greater range of emotions, relative to genuine descriptions. Deceptive descriptions of remorseful emotions were commonly associated with the presence of happiness and surprise. This may reflect the incomplete fabrication of deceptive, negative emotions, and the leakage of genuine, positive emotion in falsified accounts. Attempts to express falsified sadness involve complex and involuntary muscles in the forehead. While most people can easily raise the eyebrows (*frontalis* muscle, Action Units 1 and 2; Ekman et al., 2002), it is difficult for the untrained individual to engage the *corrugator* muscle (Action Unit 4; Ekman et al., 2002) simultaneously, which furrows the brows to mimic the upper face activation associated with a genuine sad face (Ekman, 2003b). Thus, the liar activates only the *frontalis* muscle, and appears surprised. Perhaps realizing that their attempt at sadness is meagre at best, genuine happiness associated with their embarrassing display may be leaked via a smile with the lower face. Further, since genuine accounts were accompanied by fewer emotions, the emotional presentation of the liar may also reflect an over-compensatory strategy to the task, resulting in a melodramatic emotional performance about a relatively minor, non-criminal past transgression that does not warrant such a display.

Complete Description of Event. Given that both described experiences had actually occurred (i.e. all event details were genuine) and that we exerted no control over the length or specific content of each participant's narratives, it was unsurprising that differences in emotional facial presentation were not found when the entirety of the narrative was examined. Any potential

differences in presence or duration of each emotion may have been diminished by individual differences in narrative content (i.e. level of detail, description of emotion).

Micro-expressions. Micro-expressions also were examined as a potential cue to emotional deceit and relative frequencies suggested that they may reveal one's true affective state. Micro-expressions often signalled sadness during genuine remorse and anger during fabricated guilt. While sadness is a component of remorse, anger is generally considered to be discordant with feelings of regret (Smith, 2008). Thus, these very brief expressions may indeed reveal covert (and unconcealed) feelings, as proposed by Ekman and Friesen (1975). The finding that micro-expressions (overall) were equally common among genuine and deceptive expressions highlights the importance of considering the expressed emotion in context rather than simply interpreting the presence of a micro-expression as a signal of deceit. It also is interesting to note that anger—an emotion singled out by Darwin (1872)—was revealed by the upper face (involving Action Units 4, 5 and 7; Ekman et al., 2002). The muscles underlying these action units should be of specific interest in future investigations as they may be those which Darwin (1872) described as being “least obedient to the will” (p. 79). Despite the (tenuous) support for micro-expressions as a cue to deceit reported here, it should be noted that micro-expressions occurred in less than 20% of all narratives and were not an infallible cue to deception (or truth) in all cases. While further research on this phenomenon certainly is warranted, empirical research to date suggests that over-reliance on micro-expressions (e.g. in security settings; Ekman, 2006) as an indicator of credibility is likely to be ineffective (Weinberger, 2010).

Emotional Sequences. In addition to the presence of expressed emotion, we also found that the sequences of emotional expressions for genuine remorse were different from those for falsified remorse, but only in the lower face. Genuine participants rarely displayed immediate transitions between positive and negative emotions, and their transitions in and out of positive and negative emotions occurred through neutral emotions. This same pattern occurred in deceptive remorse, but less strongly. In fact, deception involved relatively more frequent direct transitions between positive and negative emotions, and relatively fewer indirect sequences via neutral emotions. The internal states and preoccupations that are involved in deception apparently cause liars to make more frequent, abrupt transitions between positive and negative facial emotions. To our knowledge, these sequential patterns have not been previously reported.

The fact that emotional deception was revealed by the lower face (i.e. muscles surrounding the mouth) replicates findings of Porter and ten Brinke (2008) who found that masked emotions were most often betrayed by leakage of inconsistent expressions in the same area. This examination of emotional sequences, however, is a novel approach to deception detection and offers new insights into the processes involved in emotional deceit. Genuine negative emotions expressed in the lower face almost always were followed by a neutral expression. Thus, it might be concluded that genuine expressions of remorse are experienced as a “linear series” of universal emotions, separated by returns to a neutral baseline state. In contrast, negative expressions (i.e. sadness) in fabricated remorse are more often followed by other, positive and negative, emotions. This emotional turbulence may provide some indication as to the liar's actual affective state. For example, after an attempt to appear sad, the liar—knowing that his/her expression does not appear credible—may smile in genuine delight or embarrassment. In general, these findings are consistent with the notion that emotional deception may be betrayed by leakage of the liar's true emotion and/or the deceiver's over-the-top performance, resulting in a diverse emotional display.

Verbal and Body Language Cues to Falsified Remorse

Despite exhibiting non-significant mean differences for the majority of body language and verbal behaviours, participants did show significantly more speech hesitations (e.g. um, uh, er) while telling a story accompanied by fabricated remorse compared to their genuine remorseful story. An increase in speech hesitations generally is associated with an increase in cognitive complexity (DePaulo et al., 2003; Vrij & Heaven, 1999). Given that the increase in cognitive complexity in the fabricated remorse condition was minimal (i.e. emotion only), speech hesitations may be a particularly sensitive measure of cognitive resources utilized.

Future Directions and Implications

The face-to-face contact with an offender during a parole interview has a large impact on decisions regarding release (e.g. Ruback & Hopper, 1986). As such, identifying reliable behavioural cues that can differentiate genuine and fabricated remorse could have considerable practical implications. The current findings can be of practical relevance to forensic psychologists, parole officers and legal decision-makers when assessing the veracity of remorseful displays. Although further research is necessary before such cues inform aggravating or mitigating factors in the courtroom, clinicians may find this research useful in

detecting and confronting “crocodile tears”, potentially resulting in more honest and effective treatment of offenders.

Further research should examine behavioural indicators of falsified remorse in a sample of criminal offenders and for more severe transgressions. To strengthen the paradigm employed here, future researchers should confirm the veracity of each event described by participants to ensure that findings are truly a result of emotional, and not event, description. In addition to replicating the current findings in a forensic sample, it would be interesting to examine the predictive power of such cues. For example, one could assess facial, verbal and body language cues to deceit, and examine the correlation between the presence of such indicators and the number of successful days on release. It is conceivable that subtle facial cues associated with deception could be potent predictors of recidivism. In a similar line of research, Gottman and Levenson (2000) found that a detailed examination of emotional expressions during brief newlywed interactions could predict marriage longevity with 93% accuracy. Specifically, expressions of contempt were predictive of early divorce, while a lack of positive affect predicted later divorce and genuine displays of happiness were a strong indicator of marriage stability. If similar relationships were found between offenders’ emotional expression in parole hearings and success upon release, release decisions certainly could be enhanced for the safety of society. In general, further research is necessary to gain a greater understanding of this common and consequential human affective experience.

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