Faking Faces:

Psychopathic Traits and Feigned Emotional Expressions

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Abstract

The purpose of this study was to determine what effect psychopathic traits have on the ability to express both genuine and feigned emotional expressions through a detailed analysis of facial characteristics of emotion. Despite the wide array of research on psychopathic traits and emotional dysfunction, most studies have focused on recognition rather than expression of emotion. Participants (n = 121) were assessed for psychopathic traits and randomly assigned into a feigned or genuine emotional condition, and asked to display each of the six core emotions (i.e., happiness, fear, anger, surprise, disgust, and sadness). Each face was then coded for the presence of facial musculature action units using a standardized coding system. Results indicated that those in the feigned group produced more authentic facial expressions than their genuine counterparts. Limited main effects were found related to psychopathy and overall facial expressions; however, interesting patterns of specific action units were noted. Specifically, those high in psychopathic traits engaged in more authentic and pronounced expressions of specific facial musculature movements in some emotional expressions (i.e., fear and disgust). Implications concerning methods of coding, emotion induction, and facial affective mimicry are discussed.

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Faking Faces:

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The ability to determine what emotion people are feeling and whether those emotions are genuine enables us to navigate our social worlds. Deciphering facial emotions in others often provide us with our first indication of trustworthiness or authenticity. This skill also may assist us in avoiding potentially dangerous and/or criminal situations (i.e., scams, luring, kidnapping). While most research has focused on emotion *recognition*, the present study was designed to examine specific facial musculature differences in the *generation* of genuine versus feigned expressions of emotions. We also were interested in how displays of facial emotion may vary for individuals with emotional processing deficits, in particular, individuals with psychopathic traits. The psychopath is regarded as having inherent emotional impairments. That said, these individuals also appear to be extremely skilled in deception and manipulation. Given that deception and manipulation are often dependent on one's ability to successfully interpret emotions in others, and display appropriate and authentic-looking emotional responses, we sought to reconcile how emotional processing deficits are manifested in the generation of emotional expressions in persons with high versus low levels of psychopathic traits. Past research suggests that psychopaths may not be as emotionally impaired as once suspected, and that they may display enhanced abilities to mimic emotion (i.e., fear) in order to successfully manipulate others (Book et al., 2015). That said, the study of how psychopathic individuals generate and display other primary emotions has been relatively neglected in past research, as well as whether they exhibit variations in expression as a function of veracity. As a result, the present study aimed to address the role of psychopathic traits in the facial characteristics of genuine and feigned expressions of each primary emotion.

Facial Expressions of Emotion

The manner in which we express emotion through facial expression is a critical component of social interactions, and has been the subject of much psychological research. In general, core emotional expressions have been considered universal, cross-cultural, and biologically rooted based on the evolutionary adaptiveness of such expressions (e.g., Darwin, 1872/1965; Ekman, 1977; Hess & Thibault, 2009; Izard, 1971). Specifically, early research provided strong support for the presence of six core emotions (i.e., happiness, anger, fear, disgust, sadness, and surprise; Ekman, 1970; Ekman & Friesen, 1971; Izard, 1971) and more recent studies have established the potential universality of a few more (i.e., shame, pride, contempt; Ekman, 1999; Ekman & Friesen, 1986; Tracy & Robins, 2008). While the existence of universal primary emotions has been questioned in recent years based on methodological and theoretical biases inherent in the original studies (such as the influence of sight and social learning; Birdwhistell, 1963; Genderson et al., 2014), additional research utilizing visually impaired, young, or media-isolated samples has affirmed that primary emotions are readily recognized by most cultures (e.g., Ekman & Friesen, 1971; Matsumoto & Willingham, 2009; Sullivan & Lewis, 2003).

These results also seem to apply to the *expression* of emotion using facial movements. Although some studies have demonstrated that social cues and cultural contexts may play a role in dictating how each individual displays their own emotions (e.g., Galati, Scherer, & Ricci-Bitti, 1997), research also has found specific musculature movements that are associated with the genuine expression of these primary emotions (Kohler et al., 2004). For example, happiness has been linked to the following facial musculature: raised inner eyebrows, cheeks, and upper lip, upturned lip corners, and tightened lower eyelids, whereas fear has been related to a jaw drop,

and raised upper eyelid (Kohler et al., 2004). Picking up on his earlier work, Ekman and his colleagues derived an entire facial musculature database pertaining to each of the major emotional expressions entitled the Facial Action Coding System (FACS; Ekman, 1999; Ekman, Friesen, & Hager, 2002). The FACS is a comprehensive system measuring facial musculature movements. Each movement is broken down into an action unit (AU), and AUs form together to make differing facial expressions (e.g., Disgust: AU9 - nose wrinkler + AU10 - upper lip raiser; Ekman and Friesen, 2002b)**.** Research has suggested that the reliability of detecting the existence of AUs in both self-taught and instructed FACS users were high, although coding for the intensity of each AU tends to be less reliable and with greater variability across raters (Ekman & Friesen, 2002a). As a result of these efforts and much past research, it is evident that the genuine expression of primary emotions can be readily recognized, and that each emotion is associated with particular facial movements that can be quantified using the FACS.

Feigned Emotions

Along with the universality of emotional expressions, comes the ability to feign and/or conceal emotions. In particular, it has been acknowledged that feigned emotional expressions may differ in appearance from those that are genuine (Ekman & Friesen, 1982; Ekman & Friesen, 2003). In their classic example of the Duchenne v. Pan Am smile, Ekman and Friesen (1982) noted that genuine smiles (termed the Duchenne smile after French anatomist Duchenne de Boulogne) were associated with specific characteristics such as the orbicularis ocili contraction (i.e., crows feet) and the zygomatic major (i.e., when the lip corners pull up). Conversely, the fake joy smile (aptly named the Pan Am smile after the fake smiles exhibited by flight attendants) contained only the voluntary zygomatic major action. As a result, it was believed that differences between genuine and feigned emotion may be manifested in different

facial musculature (Ekman, 1984). However, research has demonstrated that some are able to successfully reproduce a feigned Duchenne smile (e.g., Gunnery, Hall, & Ruben, 2013), and that feigned emotional expressions might emerge as intensified genuine expressions (e.g., pain; Craig et al., 1991; Larochette et al., 2006). Ekman and Friesen (2003) suggested that in order to display deceptive emotion, one must call upon previous personal experience with any given emotion so as to voluntarily make adjustments to portray that emotion. Further, Buller and Burgoon (1998) argued that deception itself is innately emotional, insofar as "emotions provoke deception and deception provokes emotions" (p. 381). It is understandable then, that faked emotional expressions also contain elements of genuine expression.

Ekman and Friesen (2003) have suggested that one may be able to detect facial deceit through multiple avenues. One such avenue, morphology, or that pertaining to the actual appearance of the face, is a clue often used in everyday life. For example, when "simulating fear, [someone] will probably assume a fear mouth and staring eyes, [but may have] a blank brow/forehead" (Ekman & Friesen, 2003, p.148). Another more recently popularized detection tactic is the micro-expression, or the genuine facial expression that may appear on the face for under one second. These expressions often occur during speech and are immediately followed by a feigned emotional expression (Ekman & Friesen, 2003). Although one may be able to detect facial deceit utilizing analysis of facial musculature, what remains unclear is whether manifestations of emotion in facial expressions might differ not only as a function of veracity, but also dependent upon the emotional processing abilities (or lack thereof) of those generating the expression.

Psychopathy and Emotional Expressions

Perhaps one of the most pervasive psychological disorders associated with deception and emotional processing deficits is psychopathy. Psychopathy is characterized by clusters of impulsive, antisocial, interpersonal, and affective traits (Hare, 1996, 2001; Hare & Neumann, 2008; Steuerwald & Kosson, 2000). Most notably, many scholars consider the emotional processing deficits present in psychopaths (e.g., shallow affect, lack of empathy, coldheartedness/callousness, superficial emotions, manipulation and deception) to be the core hallmark traits of the disorder and the key features of the psychopathic personality outside of forensic and/or clinical settings (e.g., Babiuk & Hare, 2006; Dutton, 2012; Hall & Benning, 2006). In fact, it has been argued that the psychopath is innately emotionless and if they do experience emotion, it is often fleeting (Cleckley, 1976). That said, despite these deficits, psychopaths seem to be highly adept at manipulating others emotions (e.g., Grieve & Mahar, 2010) and identifying emotionally vulnerable populations (i.e., previous victims; Book, Quinsey, & Langford, 2007; Wheeler, Book, & Costello, 2009). Babiak and Hare (2006) argued that these manipulative abilities make psychopaths "near-perfect invisible human predator[s]" (p. 39); yet the mechanisms utilized by psychopaths when engaging in social predation and emotional manipulation are largely unclear.

Extant research has primarily focused on the ability of psychopaths to recognize and identify various emotions given their impairments in emotional processing. In general, psychopaths demonstrate a marked inability to accurately identify emotional expressions (e.g., Dawel et al., 2012; Hastings, Tangney, & Stuewig, 2008; Prado et al., 2015). Some studies have found that psychopaths may show an enhanced ability to detect negative emotions, such as fear or sadness, for victim selection purposes (e.g., Woodworth & Waschbusch, 2008). However,

neurological and psychological studies seem to indicate that psychopaths, including children with psychopathic tendencies, demonstrate a decreased ability when trying to identify fearful and sad expressions (e.g., Blair et al., 2001; Eisenbarth et al., 2008; Hastings et al., 2008; Stevens et al., 2001). It has been suggested that these deficits originate from lower volume and activity levels evidenced in the brains of psychopaths, and in the amygdala in particular (e.g., Blair, 2003; Dawel et al., 2012; Karatsoreos & McEwen, 2012; Kiehl et al., 2001). While generalized impairment may be evident, psychopaths also show enhanced abilities to identify vulnerable persons (e.g., Book, Costello, & Camilleri, 2013; Book, Quinsey, & Langford, 2007; Wheeler, Book, & Costello, 2009). It is conceivable that this ability is likely dependent upon some level of emotional recognition. As a result, while psychopaths may show marked impairment in emotion recognition, they may still be able to engage in emotional processing in some circumstances.

Interestingly, research on emotion recognition tells us little about how psychopaths express emotion themselves. In particular, it is unclear whether their emotional processing deficits are associated with "feigned" emotion cues (i.e., distinctive signs of faking) or whether they can successfully mimic genuine emotional expressions. It can be assumed that being able to feign emotional expressions is a mechanism utilized by psychopaths as an efficient means of social predation (i.e., manipulating and/or victimizing others; Buller & Burgoon, 1998; Hare, 2001). In general, past studies have suggested that high levels of emotional intelligence (and corresponding levels of *high empathy*) are related to enhanced abilities to identify emotions and engage in affective facial mimicry (e.g., Balconi & Canavesio, 2016; Grieve & Mahar, 2010; Hofelich & Preston, 2012; Kahn, Ermer, Salovey, & Kiehl, 2016; Porter, ten Brinke, Baker, & Wallace, 2011; Rivers, Wickramasekera, Pekala, & Rivers, 2015). These studies suggest that individuals with psychopathic traits should also be impaired in terms of their emotional

expressions. However, only few studies have addressed emotional expressions *generated* by psychopaths, and whether they vary substantively from those who are not high in such traits. For example, Porter et al. (2011) examined the role of psychopathy in adopting facial expressions of others while controlling for leakage of deceptive cues. Of note, they found that psychopathic individuals were able to deceptively display emotional expressions and showed less emotional leakage relative to non-psychopathic individuals. Specifically, this study indicates that psychopaths may be able to successfully mimic the emotions of others (Porter et al., 2011).

Of particular relevance to the present study, Book et al. (2015) had nonclinical and forensic populations generate fearful facial expressions, which were later coded in terms of their facial action units. Their results indicated that those high in psychopathic traits were more successful at affective/emotional mimicry. Specifically, use of more "typical" action units (i.e., those that are usually present in fearful faces such as raised brows/open mouth) and greater external ratings of the "genuineness" of the expression were most associated with fearful faces displayed by those high in psychopathy (Book et al., 2015). This study contradicts the above-mentioned association between high empathy (i.e., non-psychopaths) and better mimicry abilities (e.g., Hofelich & Preston, 2012). That said, it is unclear as to whether recognition and mimicry of fearful expressions may be unique to psychopaths (i.e., greater experience with this expression over others in relation to victimization/manipulation of others), or if their ability to successfully mimic genuine expressions extends to other emotional expressions. Thus, the present study was designed to evaluate whether psychopathic traits are associated with the ability to be "emotional chameleons" of sorts, where affective mimicry extends across the universal emotions and may be useful for social manipulation.

The Current Study

The current study was designed to re-evaluate extant literature focusing on the ability of those with psychopathic traits to *express*, rather than *detect*, facial emotions. In addition, we sought to determine whether different facial action units were evident across genuine versus feigned expressions, and if these varied as a function of psychopathic traits and emotion type. This study utilized a 2 (veracity: genuine/feigned) x 6 (emotion type: happy/surprise/sad/fear/anger/disgust) x 2 (psychopathic traits: high/low) mixed subjects design, with facial action units being the primary dependent variables. Based on this design, we predicted that faces produced by participants in the genuine condition would contain more action units indicative of authentic expressions relative to those in the feigned condition. That said, the evaluation of psychopathic traits in relation to veracity would produce different outcomes. Specifically, those high in psychopathic traits will be impaired at expressing emotion in the genuine condition; whereas they may produce more exacerbated expressions in the feigned condition in their attempts to mimic emotion (relative to those low in psychopathic traits). Finally, we predicted that the presence of authentic action units across different types of emotions may vary as a function of psychopathic trait levels. In particular, we expected that participants high in psychopathic traits may be better able to mimic or feign negative emotions (i.e., sadness, fear, anger, and disgust) than positive emotions (i.e., happiness, surprise).

Method

Participants

The sample comprised of undergraduate psychology students (N = 121) from MacEwan University, including 98 female (81.0 %) and 23 male (19.0 %) participants with a mean age of 19.96 years (SD = 3.55, range = 17-41). All participants involved in this study provided informed

consent, were awarded course credit, and were treated in accordance with TCPS-2 ethical guidelines.

Measures

Demographic questionnaire. This questionnaire contained 10-items that assessed basic demographic information for each participant (i.e., age, sex, ethnicity, academic major, year of study, number of previous psychology courses), including two 7-point Likert rating scales (i.e., participants level of emotionality and perceptions of their ability to hide their own emotions) and two YES/NO questions concerning lie and emotion detection abilities (i.e., do you believe you can tell what a person is feeling by looking at their face?).

Psychopathic Personality Inventory – Revised (PPI-R). The PPI-R (Lilienfeld & Widows, 2005) is a 154- item self-report questionnaire aimed at assessing the degree to which an individual displays personality traits associated with psychopathy. Participants respond to all items (e.g., “I like to stand out in a crowd”, or “I sometimes lie just to see if I can get someone to believe me”) on a 4-point Likert scale indicating whether each statement applies to them (from 1 = false to 4 = true). The PPI-R contains three overall factors (i.e., fearless dominance, self-centered impulsivity, and coldheartedness), as well as eight trait subscales (i.e., Machiavellian egocentricity, rebellious nonconformity, blame externalization, carefree nonplanfulness, social influence, fearlessness, stress immunity, and coldheartedness) and four validity scales (i.e., virtuous responding, deviant responding, inconsistent responding 15, and inconsistent responding 40). All scores can be summed to provide an overall score, and each factor and subscale also can be assessed in relation to varying behavioural outcomes. The PPI-R has respectable discriminant and convergent validity, and is a commonly utilized measure appropriate for non-clinical

assessment of psychopathic traits (e.g., Anderson, Sellbom, Wygant, & Krueger, 2014). In our study, participants were categorized as low, moderate, or high on levels of psychopathic traits in accordance with standardized T-scores in order to permit group comparisons (Lilienfeld & Widows, 2005).

Emotional and non-emotional image stimuli. Emotion-specific stimuli (e.g., anger) were obtained from the NimStim Set of Facial Expressions (Tottenham et al., 2009), which is a database of 672 images displaying a variety of emotional expressions (i.e., happy, sad, disgust, fear, anger, surprise, neutral, and calm) at varying levels of intensity. The NimStim is a sizeable, interracial dataset containing images of facial stimuli deemed emotionally interpretable for inexperienced individuals, making this set suitable for undergraduate populations. The set has displayed good reliability and validity (shown when an individual was able to accurately identify an emotion; Tottenham et al., 2009). For the purpose of the present study, only images displaying the six core emotions identified by Ekman (1970) were utilized (i.e. happy, sad, anger, fear, surprise, and disgust), where 10 images of each emotion were randomly selected from the NimStim database only for participants in the *feigned* emotion condition. These images were utilized to prompt or cue participants as to what different displays of each core emotion may look like.

Non-emotional image stimuli were derived from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2008), where 30 images devoid of emotional content were utilized as a "neutralizer" between emotional facial displays for all participants. In particular, five of the 30 images were randomly displayed for a total of 10s each following each emotion type. Neutral IAPS image stimuli were selected on the basis of little to no emotional intensity as well as a neutral emotional valence as indicated in the manual (e.g., Lang et al.,

2008), and primarily contained scenes of landscapes or objects (e.g., picture of a door, people picking berries in a field, woman sitting in an auditorium). The IAPS is a large, normatively derived database containing emotionally valenced images that vary in their level of emotional intensity or arousal. It has been frequently used in emotion- and attention-driven research across a variety of domains, and serves as a useful tool for replication purposes (Bradley & Lang, 2007; Lang et al., 2008).

Facial Action Coding System (FACS). The FACS (Ekman, Friesen, & Hager, 2002a) is a thorough facial movement instrument used to assess emotional authenticity and musculature action within facial displays of emotion. The FACS systematically breaks down every musculature movement (called action units; AU) a face is able to display, and includes a comprehensive listing of AUs corresponding to a particular emotional expression (e.g. AU1: signifying an inner eyebrow raise, evident in both surprise and fear; Ekman et al., 2002a; Ekman et al., 2002b). The more AUs consistent with a particular expression, the more authentic that expression is deemed. In the current study, participant photos were scored for the presence of each action unit as 0 (not present), 1 (partially present), or 2 (definitely present) in relation to each emotional expression (i.e., Fear: AU1/2/4/20). Interrater reliability was assessed by having a second rater (blind to veracity condition) recode slightly more than 20% (n = 26) of the participant faces, resulting in an acceptable interrater reliability of κ= .828, as per the FACS manual (Ekman et al., 2002a)[1].

Participant photographs. Photographs of all emotional expressions generated by participants in the present study were taken using a 16.2-mega pixel Sony Cyber-shot camera, set at a standardized 5.0 zoom. The camera was positioned on a tripod approximately two feet away

[1] Due to time and coding restraints, it was not always possible for the primary coder (JS) to be blind to participant condition given that this rater also ran the majority of experimental participant sessions. However, data collected by one rater was assigned to be coded by the secondary rater where possible..

from participants and was situated at a standardized distance and location for each participant. All photographs were taken under uniform lighting conditions against a white backdrop, and participants were advised to remove anything that may obstruct the view of their face (i.e., hats, glasses).

Procedure

This in-person study utilized participants from the undergraduate psychology research pool at MacEwan University who signed up for a study on "Emotional Expressions and Personality" using the online SONA participant scheduling software. Before their experimental session, participants were randomly assigned to either the feigned or genuine emotional condition. Upon arrival at the forensic research lab, each participant was stationed at a computer and completed two consent forms: (1) the primary consent designed for the current study, and (2) a secondary consent form requesting use of participant photographs in future research[2]. After providing consent, participants began their experimental session by completing the demographic questionnaire, followed by the PPI-R. Participants were then given specific verbal instructions associated with the emotion condition they had been assigned to (genuine or feigned). The procedure deviates slightly across these two conditions, as discussed below.

Feigned. In the feigned condition, participants were given the following instructions: "The emotional expressions that you will be asked to show on your face today are to be FAKE and not genuinely felt. For example, we want you to pretend you are trying to show this emotion on your face without feeling the actual emotion (like you are "faking it" to try to convince someone else you are feeling that emotion)." The experimenter also advised each participant that they should spend time looking at each photograph presented and practice how they would fake

[2] Note: Participants were free to decline consent regarding future use of their photographs, and this did not influence their credit or eligibility to participate in the present study.

being “happy” if you were trying to cover up your real feelings. Each of the six core emotions was randomly presented, and participants were advised that they would view a series of pictures displaying each particular emotion (i.e., 10 randomly selected “happy” emotional expressions from the NimStim Set (discussed above). They were instructed to look at each for at least 5 seconds before proceeding to the next picture, and to really examine what specific facial features were involved in each emotional expression. After viewing the 10 images, participants were directed to the chair in which all photos were taken from, and asked to “think about the faces you just saw and show me to the best of your ability what that emotion looked like in your face”. Their photograph was taken to capture each emotional expression.

Genuine. In the genuine condition, participants were given the following instructions: “The emotional expressions that you will be asked to show on your face today are to be REAL and genuinely felt.” The experimenter also utilized an induction procedure to get each participant to try to think about or remember a time when they felt each emotion, and to spend a few moments thinking of a personal experience associated with that emotion. If participants were able to recall a genuine personal experience (considered direct emotion), they were encouraged to further focus on that memory and how the situation made them feel prior to their photograph being taken. If participants were unable to recall a genuine personal experience, they were encouraged to think of a time when they saw someone else experience that emotion (i.e., friend, or in a movie, novel, commercial, or story). These were labelled as indirect emotion, and participants were asked to think of how the person or character was feeling and to show that on their face. Their photograph was taken to capture each emotional expression.

For both conditions, each of the six emotions were presented in a randomized order and participants were asked to rate the extent to which they were feeling each emotion following

each photograph as a manipulation check. The neutralizing task (i.e., exposure to 5 neutral image stimuli from the IAPS image set) was administered following each emotional expression with the intent of bringing the participant's emotional valence back to a neutral level, prior to engaging in the next emotional expression display. After completing all six emotions and neutralizing tasks, participants were then debriefed and awarded their course credit, concluding their participation. Once all facial image data was attained, these were distributed across three coders trained in the FACS, and AU's associated with each facial expression were coded and entered into a spreadsheet for later analysis.

Results

Emotional Expression Scores, Veracity, and Psychopathy

In order to examine the influence of psychopathic traits (low/moderate/high) and veracity (genuine/feigned) on the "authenticity" of emotional expressions, univariate analyses of variances (ANOVAs) were conducted utilizing an overall authenticity score per face as the dependent measure[3]. The mixed ANOVA contained one within-subject factor: emotion type (happy/surprise/sad/fear/anger/disgust) and two between-subjects factors: veracity (genuine/feigned emotion condition) and psychopathic traits (high vs. low). The results revealed that for each emotion (with the exception of happiness), there was a significant main effect of veracity where feigned faces were rated as containing more partial or definite presence of action units (indicative of authenticity) relative to genuine faces[4] (see Table 1 for means, standard deviations, and ANOVA values).

[3] Authenticity scores were calculated based on the addition of each individual action unit score (0-2) divided by the total number of action units possible per emotional expression. This method of coding is based on the FACS and has been used in previous research (i.e., Book et al., 2015).
[4] For disgust and anger expressions, this main effect approached statistical significance but can be classified as significant for exploratory investigation (i.e., below .10).

Surprise. Apart from the overall main effect, further analysis of surprise expressions just utilizing a high/low dichotomy of psychopathic traits also yielded a main effect of veracity condition ($F(1,52) = 27.59$, $p < .001$), and a main effect of psychopathy that approached significance ($F(1,52) = 3.20$, $p = .08$). Specifically, high levels of psychopathic traits ($M = .452$, $SD = .323$) were associated with less authentic surprise expressions relative to low psychopathic trait levels ($M = .494$, $SD = .337$).

Sadness. Evaluation of low/moderate/high psychopathic trait levels revealed not only a main effect of condition (see Table 1), but also an interaction between veracity condition X gender ($F(1,78) = 3.07$, $p = .084$). Further investigation of this effect across only low and high psychopathy groupings revealed main effects of veracity ($F(1,52) = 27.32$, $p < .001$) and the veracity X gender interaction ($F(1,52) = 3.11$, $p = .084$). Specifically, sad expressions were considered more authentic in the feigned relative to genuine condition. Further, female participants had higher scores for authenticity in the genuine condition relative to males, whereas males had higher scores for authenticity in the feigned condition relative to females (see Figure 1).

Fear and Anger. In both the original and follow up ANOVA analysis using solely low or high psychopathic trait groups, feigned expressions of fear were rated as more authentic according to the FACS criteria relative to genuine faces ($F(1,52) = 12.85$, $p = .001$). Similarly, angry expressions were rated as more authentic when faked relative to participants asked to display an expression of genuine anger ($F(1,52) = 12.96$, $p = .001$).

Disgust. Finally, follow-up analyses of disgust expressions yielded several exploratory statistical effects, including a main effect of veracity condition ($F(1,52) = 3.31$, $p = .075$), as well as an interaction between gender X psychopathic trait level ($F(1,52) = 3.33$, $p = .074$). While

feigned expressions were again rated as more authentic utilizing the FACS, the interaction term revealed that males displayed more authentic disgust expressions overall relative to their female counterparts. That said, males low in psychopathic traits produced the highest authenticity scores, whereas for females, women high in psychopathic traits produced authentic disgust expressions more often (see Figure 2).

Individual Action Units, Veracity, and Psychopathy

In order to determine if psychopathy level (low/moderate/high) and veracity (genuine/feigned) influence the expression of individual action units (AUs) within each emotional expression, a multinomial logistic regression was conducted for each face and AU[5]. All of the considered models displayed acceptable model fit indicated by Likelihood Ratio Statistics, Omnibus-tests, and Nagelkerke *R*-squared shown in Table 2.

Sadness. The multinomial analysis revealed a main effect of psychopathy in relation to AU1, Wald χ^2 (1) = 5.21, $p < .05$, as well as an interaction effect of exploratory significance between psychopathy X veracity for this same AU1 (Wald χ^2 (1) = 2.89, $p = .08$). These results indicated that individuals in the moderate psychopathic trait group produced more subtle inner brow raises overall (i.e., more partially present ratings); however, those high in psychopathy who were faking expressions also were likely to produce partial AU1s. Similarly, analysis of AU17 (chin raiser) revealed interaction effects with veracity for both high (Wald χ^2 (1) = 3.97, $p < .05$) and moderate (Wald χ^2 (1) = 2.85, $p = .09$) levels of psychopathy where both of these groups produced more partially present AU17s in the feigned emotion condition. Finally, in relation to AU15 (lip corner depressor), another interaction between psychopathy X veracity was yielded

[5] Results are only included for emotional expressions that had significant AU effects.

(Wald χ^2 (1) = 3.92, $p < .05$), demonstrating a relation between moderate levels of psychopathy and strong presence of AU15 in feigned expressions.

Fear. Analysis of AUs associated with fear revealed that individuals moderate to high in psychopathy produced a pattern of both subtle and overt action units present more in feigned faces relative to genuine faces. In particular, interactions between veracity and moderate to high (Wald χ^2 (1) = 6.92, $p < .01$; Wald χ^2 (1) = 6.33, $p = .012$) levels of psychopathy were evidenced for AU1 (inner brow raiser) for partially and definitely present AU ratings (respectively). Similarly, for AU2 (outer brow raiser), moderate **(**Wald χ^2 (1) = 3.37, $p = .06$; Wald χ^2 (1) = 7.25, $p < .01$) and high (Wald χ^2 (1) = 4.64, $p < .05$; Wald χ^2 (1) = 8.09, $p < .005$) levels of psychopathy were associated with both partially and definitely present AU ratings (respectively) for feigned faces only relative to genuine faces.

Disgust. The primary action unit for disgust pertains to the nose wrinkler (AU9). Statistical analysis of this AU indicated interactions between veracity and both moderate and high levels of psychopathy; indicating a greater degree of definitely present ratings in the feigned condition relative to genuine disgust expressions (Moderate: Wald χ^2 (1) = 5.38, $p < .05$; High: Wald χ^2 (1) = 5.94, $p < .05$).

Anger. Finally, the regression analysis indicated that participants who were low in levels of psychopathy were substantially more likely to produce partially present (i.e., subtle) brow lowering actions (AU4) in feigned versus genuine expressions (Wald χ^2 (1) = 245.72, $p < .001$).

Discussion

Veracity of Emotions

The purpose of this study was to investigate the influence of psychopathic traits on the ability of individuals to generate genuine and feigned emotional expressions. Our first prediction

was in relation to how facial expressions varied across genuine and feigned conditions. In particular, we predicted that participants assigned to the genuine emotion group would display emotional expressions containing more action units indicative of authenticity relative to the feigned group. This prediction was not supported. In fact, across all emotion types where statistically significant findings were evidenced, feigned expressions were associated with higher authenticity scores.

Several possible explanations for these contradictory findings exist. First, it is possible that the nature of the coding system and action units deemed "genuine" by the FACS. In general, action units that are associated with each primary emotional expression are deemed to be indicative of genuine emotion (Ekman, Friesen, & Hager, 2002a). In addition, the FACS showcases many, if not all, musculature movements that may be present at one time or another in the face in either a subtle or overt capacity (Ekman, Friesen, & Hager, 2002b). That said, in order to assess what action units were associated with each emotion, the authors of the FACS appeared to simply take photos of themselves showing each primary emotion and then parsing these into individual AUs (Ekman, Friesen, & Hager, 2002b). What is problematic is that the manual fails to elucidate whether each emotion was *induced* prior to the photo being taken, or whether the actor in the photo was simply asked to "show us the emotion of fear" [6]. Specifically, the former would be suggestive of genuine emotion, whereas the latter is more likely feigned and may lack reliability with true authentic expressions. Although the manual associates the presence of these AUs with authenticity (Ekman, Friesen, & Hager, 2002a, 2002b), in truth it may be that the AUs identified in the FACS manual are more prevalent in "put on" expressions (i.e., displayed but not felt). For example, previous studies have demonstrated that voluntary or feigned emotional

[6] The FACS manual specified that participants were given the opportunity to practice each emotional expression, implying they were more likely feigned in origin.

expressions are more likely to contain facial asymmetries when compared to involuntary emotional expressions (e.g., Ekman, Hager, & Friesen, 1981); yet within the FACS these unilateral or asymmetrical AUs are illustrated for coding and analysis (i.e., AU6 on one side and AU7 on the other; Ekman, Friesen, & Hager, 2002b). Although the FACS may prove to be a reliable way to measure musculature movements within the face, it may not be well suited when identifying truly genuine versus feigned emotional expressions as it failed to clearly elucidate the latter. In fact, our data suggest that the AUs that received "definitely present" ratings actually appeared to produce a seemingly more fake or over the top expressions than those rated as slightly present. This may further implicate the necessity of reorganizing the FACS in such a way that coding reflects how an expression would genuinely emerge rather than assuming that the more present or extreme the AU, the more authentic the emotion would be. For example, Mehu et al. (2012) identified AUs as belonging to either a reliable or versatile category, where reliable AUs were viewed as being mostly involuntary, while versatile AUs were viewed as controllable. This may suggest that when using the FACS, AUs should be divided according to their voluntariness to provide a clearer indication of the authenticity of the expression, with truly involuntary AUs being strongly related to authenticity and voluntary AUs less so as they could be produced in both genuine and feigned expressions. Expanding on the work by Mehu et al. (2012), the best way to establish an authentic coding system or improve the FACS would involve creating a database of candid, genuine emotional expressions and the AUs that correspond to these expressions (e.g., Sebe et al., 2007).

In the present study, our methodology attempted to account for this difficulty by utilizing an emotional induction procedure; however, the effectiveness of this procedure may have been limited. Based on procedures used in past studies (e.g., Brewer, Doughtie, & Lubin, 1980;

Moons & Mackie, 2007), our participants were asked to recall a time in which they felt a particular emotion, and to focus on that experience, imagining the event and how they felt during the event. One problem with this method was that participants may have experienced a demand awareness effect, such that when they were asked if they had a genuine experience that corresponded to each emotion, they indicated they did when they did not. As a case in point, with the emotion of happiness, no differences as a function of veracity were revealed. In general, happy memories are commonly experienced and easily recalled by most. As a result, participants in the genuine-happy group produced AUs that were comparable to those in the feigned group, possibly because happiness can be readily induced. Conversely, it is possible that feigned expressions outperformed genuine expressions for most other emotions because participants had difficulty coming up with accessible fearful, sad, angry, disgusted, or surprised memories. While the autobiographical induction method used in our study is generally considered better than other methods (Moons & Mackie, 2007), additional induction procedures such as using movie clips or images may provide more success for mood induction (e.g., Bauer et al., 2015; Scrimin, Mason, & Moscardino, 2014).

Another problem with induction of genuine emotions overall may be that these expressions are often subtle and fleeting when participants are told to remember and relive emotional experiences (Ekman, 1984). Given the methodology of the current study, it is possible that the photographs were not taken fast enough to capture authentic expressions (e.g., Hess & Kleck, 1990). In the future, utilizing a video camera would help overcome limitations in the detection of genuine expressions. Further, studies should evaluate both the utility of the FACS as well as incorporation of various induction methods in order to elicit true expressions of genuine

emotion. That said, the authenticity of emotional expressions also may have been influenced by an individuals level of psychopathic traits across the different veracity conditions.

Psychopathy and Emotional Expressions

In relation to psychopathic traits and emotional expressions, we predicted that those high in psychopathic traits would be impaired at expressing emotion in the genuine condition; whereas they may produce more exacerbated expressions in the feigned condition in their attempts to mimic emotion (relative to those low in psychopathic traits). This two-fold prediction was only partially supported. Our data revealed that AUs produced for those in the genuine emotion group did not differ across individuals who were high or low in psychopathic traits. While this appears that impairment was not evident, re-evaluation of the FACS and what the AUs identified in the manual are really indicative of, may lend us to an alternate interpretation. Specifically, a lack of difference in AUs for genuine expressions could mean that those high in psychopathic traits were limited in their expression of real emotion, given that differences for feigned emotions were evidenced. Further, participants in the genuine condition showed such subtle AUs in almost all emotional expressions (also see discussion of induction procedures above), that the ability to differentiate between genuine psychopathic and genuine non-psychopathic expressions was restricted.

Within the feigned condition, however, multiple differences were evidenced between moderate or high psychopathic trait groups relative to low scorers. In particular, for sadness, fear, and disgust (higher levels of psychopathic traits) were more associated with both subtle and over the top expressions in relation to the degree of AUs present relative to those low in psychopathic traits. Past research has indicated that psychopaths appear to attend to facial musculature in the mouth and lower face relative to the eyes when viewing emotional faces (e.g., Boll & Gamer,

2016; Dadds et al., 2008; Gillespie et al., 2015). In relation to our study, this interpretation may explain our results for several emotions. For sadness, those high in psychopathic traits yielded more prevalent AUs in relation to the chin and lips and only subtle AUs in relation to the eyebrows. For anger, participants low in psychopathic traits displayed AUs associated with the eyes, whereas those higher in these traits did not. Thus, it makes sense that those high in psychopathy would fail to reproduce AUs pertaining to the eyes if they fail to attend to these emotional details in the first place, limiting their ability to engage in mimicry of these features. Alternately, anger may be one of the few emotions that psychopaths do genuinely experience, so they may be able to reproduce this emotion in a more subtle manner without engaging in over the top AUs when trying to "fake it" (Steuerwald & Kosson, 2000).

For expressions of fear and disgust, higher levels of psychopathic traits were related to a greater prevalence of eye-related AUs that often reflected exacerbated demonstrations of these emotions. Perhaps the saliency of expressions is not the determining factor when psychopaths attempt to display emotion; but rather that psychopaths have refined their ability to accurately mimic certain expressions in their attempt to manipulate and victimize their prey. It is possible that while psychopaths may not attend to the eyes when deciphering emotion in general, there is something distinctive about fear (i.e., excitement or arousal from perceiving fear/anguish in victims) and disgust (i.e., presence of gore or excessive violence in criminal actions) that results in greater attention to the eyes and subsequent replication of these AUs. Past studies have found that most individuals, irrespective of psychopathy level, fixate upon eyes in general when processing negative emotions (e.g., Eisenbarth & Alpers, 2011). This could suggest that individuals rating high or moderate on psychopathy are taking into account what a non-psychopath would deem as an authentic or important AU and have acquired the ability to

replicate these AUs to effectively navigate their social and/or criminal worlds. As discussed previously, Book et al. (2015) found that persons high in psychopathic traits were able to successfully mimic fear expressions, which was also confirmed in our study. To the authors' knowledge, no other studies have investigated disgust in relation to affective mimicry in psychopaths. Future research is necessary in order to further elucidate the ability of psychopathic individuals to engage in emotional mimicry, as well as what facial features they attend to and replicate to manipulate others into believing they are displaying genuine emotion.

Finally, we predicted that the presence of authentic action units across different types of emotions may vary as a function of psychopathic trait levels. In particular, we expected that participants high in psychopathic traits may be better able to mimic or feign negative emotions (i.e., sadness, fear, anger, and disgust) better than positive emotions (i.e., happiness, surprise). Overall, those high in psychopathic traits appeared to be more effective when mimicking negative emotions rather than positive ones (see also discussion above). This may stem from their ability to more readily recognize these types of emotions (e.g., Woodworth & Waschbusch, 2008); a pattern which is evidenced in non-psychopaths where mimicry enhances emotional recognition and vice versa (e.g., Stel & van Knippenberg, 2008). However, it may also stem from the possibility that those higher in psychopathic traits face more negative emotion in response to disappointment or dissatisfaction with themselves (Steuerwald & Kosso, 2000) or that they likely encounter greater experiences of negative emotional expressions in response to their own behaviour relative to positive emotions. With this greater exposure to negative emotions, there is a greater opportunity to mimic and learn. The "practice makes perfect" exemplar has previously shown to be effective in mimicry (e.g., Hess, Blairy, & Philippot, 1999). Moreover, in a study conducted by Chartrand and Bargh (1999), effective mimicry of

facial expressions, posture, and other behaviours significantly increased both the ease of interaction and the extent to which participants rated liking their partner. These examples serve to highlight the potential efficacy psychopaths may exhibit at rehearsing and learning how to produce authentic seeming expressions, as exhibited in the wake of their own socially undesirable behaviour. However, as research appears to be very limited within the area of psychopathy and practice, future research should be aimed at investigating the potential link between psychopathy and the ability to practice affective mimicry until perfection. Further, given that non-psychopathic individuals learn to mimic emotions through emotional contagion and empathy (e.g., Hess & Blairy, 2001; Hofelich & Preston, 2012), understanding the source of such "emotional learning" in psychopaths would provide much insight into their manipulations and behaviours.

Conclusion

Despite limitations within our study, several key findings can be concluded. Opposing our original prediction, participants in the feigned condition vastly outperformed those in the genuine condition relating to presence and strength of AUs indicative of authentic emotional expressions. Moreover, our data suggest that despite previous literature indicating that psychopaths may pay little attention to the eyes when processing emotion, those high in psychopathic traits in our study were more likely to reproduce AUs involving the eyes that appeared more authentic, specifically in relation to both fear and disgust. This and other studies suggest that psychopaths may be able to engage in successful affective mimicry, despite their emotional processing deficits, and that they are adept at displaying particular emotions. Our study provides insight into the ability of psychopaths to generate and display feigned emotion that appears authentic, where their capabilities may enhance the manner in which they victimize

others. Future research evaluating facial mimicry in psychopaths in relation to emotional recognition, practice, victimization experience, and individual factors is necessary.

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Table 1. *Analysis of veracity condition for each emotional expression utilizing the overall authenticity/genuineness score per face.*

Emotion Type	Authenticity Score		*F*-value (1,78)	$p <$ value
	Genuine	Feigned		
Happiness	.571 (.255)	.615 (.250)	.09	.765
Surprise	.262 (.248)	.658 (.248)	17.41	.001
Sadness	.100 (.118)	.321 (.195)	10.76	.005
Fear	.123 (.168)	.372 (.207)	10.51	.005
Disgust	.246 (.284)	.510 (.390)	3.05	.084
Anger	.494 (.378)	1.03 (.397)	3.25	.075

Table 2. *Multinomial logistic regression analysis with overall model fit for each individual AU.*

Emotion Type	Action Unit	Model of Fit $D(26)$	Omnibus Test $\chi^2(16)$	Nagelkerke R^2	$p <$ value
Sadness	AU1	27.93	25.23	.245	.066
	AU17	28.86	40.21	.352	.001
	AU15	15.76	39.82	.335	.001
Fear	AU1	30.19	44.51	.374	.001
	AU2	32.33	32.31	.304	.005
Disgust	AU9	15.76	36.93	.334	.002
Anger	AU4	25.482	50.878	.217	.001

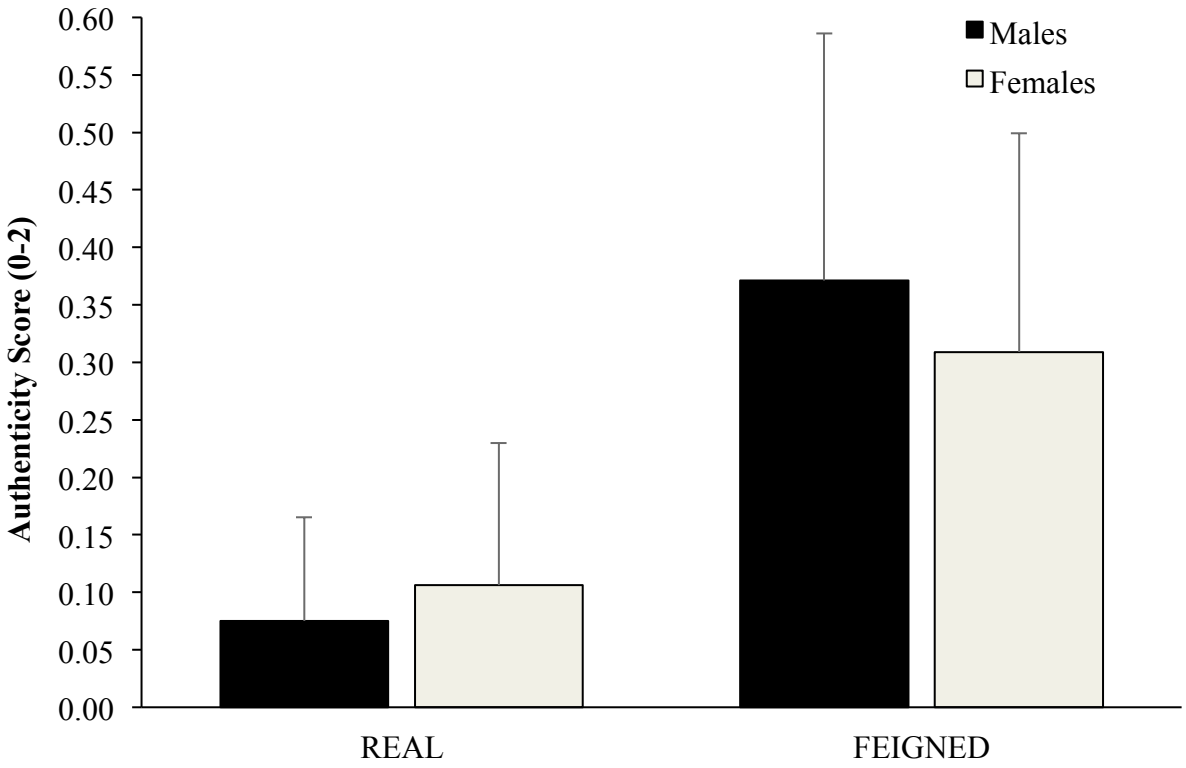

Figure 1. Authenticity scores for sad facial expressions across real and feigned veracity condition as a function of participant gender.

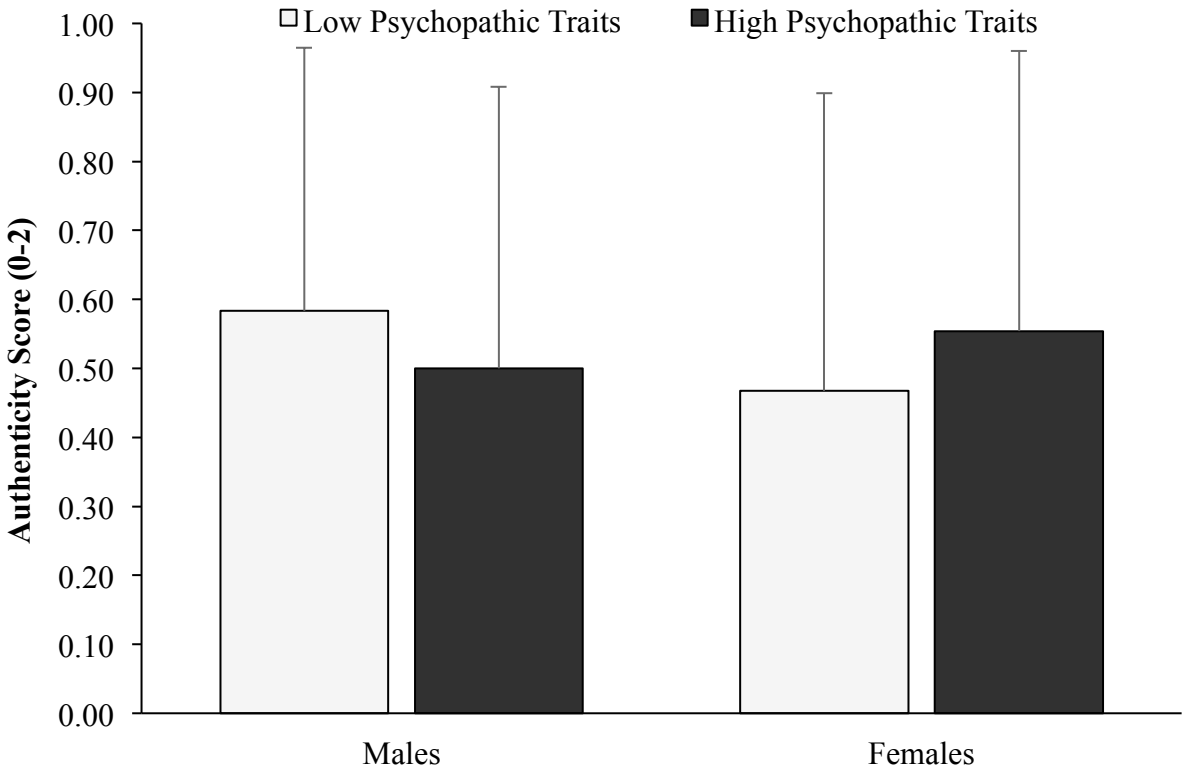

Figure 2. Authenticity scores for facial expressions of disgust across males and females as a function of psychopathic trait levels.