Emotion recognition and deception detection

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Abstract

People hold strong beliefs regarding the role of emotional cues in detecting deception. While research on the diagnostic value of such cues has been mixed, their influence on human veracity judgments should not be ignored. Here, we address the relationship between emotional information and veracity judgments. In Study 1, the role of emotion recognition in the process of detecting naturalistic lies was investigated. Decoders' accuracy was compared based on differences in trait empathy and their ability to recognize microexpressions and subtle expressions. Accuracy was found to be unrelated to facial cue recognition but negatively related to empathy. In Study 2, we manipulated decoders' emotion recognition ability and the type of lies they saw: experiential or affective. Decoders either received emotion recognition training, bogus training, or no training. In all scenarios, training was not found to impact on accuracy. Experiential lies were easier to detect than affective lies, but, affective emotional lies were easier to detect than affective unemotional lies. The findings suggest that emotion recognition has a complex relationship with veracity judgments.

Keywords: Emotion Recognition; Deception Detection; Type of Lie; Training; Facial Expressions; Empathy

Introduction

Decades of deception research has consistently found that human lie detection ability is surprisingly poor (Bond & DePaulo, 2006). People also tend to be overconfident in their ability (Holm & Kawagoe, 2010) and biased towards assuming that most statements are honest (i.e. truth-biased; Levine et al., 1999). Some scholars argue that decoders' lackluster performance is due to their poor ability to detect subtle behavioral differences between liars and truth-tellers, especially related to their emotions (Vrij, 2008). Implicitly, this assumes two elements: (1) that there exist diagnostic behavioral cues of deceit, and (2) that decoders can make rational veracity judgments if they use such cues. However, these assumptions do not accurately reflect how people make veracity judgments.

Emotion-based lie detection

Arguably the most influential approach to detecting deception has been the emotion-based approach (EBA). The EBA purports that behavioral differences between liars and truth-tellers exist and are related to the emotions senders experience and exhibit (Ekman, 2003a). Liars will "leak" subtle behavioral cues which betray their lies, referred to as *emotional cues* (Ekman & Friesen, 1969). The EBA argues that a decoder's ability to recognize emotional cues is relevant to their ability to detect deception, with more perceptive decoders being more accurate at detecting lies (Ekman, 2009).

An important distinction that needs to be made regards the differences between the EBA's claim of emotional cues being diagnostic tools for accurate deception detection and the claim that people can use such cues to make accurate veracity judgments. The EBA tends to conflate the two, with poor accuracy being treated as reflecting the absence of such cues in a specific scenario, or the lack of accurate knowledge of such cues by a decoder. This is problematic, as it assumes humans have the perceptual and cognitive mechanisms necessary to utilize emotional cues to make rational decisions.

Regarding the first claim, this has received mixed support in the literature. While research does find the existence of behavioral cues associated with deceit (Hurley & Frank, 2011), such cues also appear scarce, unreliable, and rarely veracity-specific (DePaulo et al., 2003). Thus, even astute decoders may perform poorly, as they have nothing diagnostic to decode. The second claim is the focus of the current paper.

Currently, in contrast to the criticisms of the use of emotional cues for detecting deception (see Burgoon, 2018; Vrij, 2008), we focused on how decoders' emotion recognition ability and senders' emotions impact on veracity judgments. We aim to demonstrate that emotions should not be overlooked in deception research, as they are important in understanding how social interactions unfold and how people make veracity judgments.

Emotional cues

The EBA suggests that facial expressions are the strongest source of emotional cues (Ekman, 2003b). Research on facial leakage has provided evidence that brief emotional displays are involuntary and insuppressible (Hurley & Frank, 2011), can be used to predict behavior (Gottman, Levenson, & Woodin, 2001), can impact on naïve observers' judgments (Stewart, Waller, & Schubert, 2009), and, at times, can predict veracity (Hartwig & Bond, 2011).

Differences in emotional cues between liars and truth-tellers are argued to originate from two sources. First, the emotions associated with lying (e.g., fear or guilt) produce uncontrollable behavioral differences which leak through various nonverbal channels, especially the face, referred to as the *leakage hypothesis* (Ekman & Friesen, 1969). Second, liars are unable to produce genuine-looking 'deceptive' emotional simulations due to their inability to voluntarily activate the muscles that occur naturally during felt affect, referred to as *reliable muscles* (Ekman, 2003b). The foundation of this perspective stems from early research on smiling behavior, proposing clear differences in the production of genuine and deceptive smiles (first noted by Duchenne, 1862; Ekman, 2003b). However, this perspective has been challenged, as careful examinations do not find support for such clear morphologic and dynamic demarcations in real-world facial expression production (Krumhuber & Manstead, 2009), calling into question the notion of reliable muscles.

With respect to deception, Frank and Ekman (1997) reported initial support for deception detection based on facial expressions of emotions. By manually coding mock crime videos for the presence of emotional cues they were able to classify deceptive and truthful statements with 80% accuracy. Research by Porter and colleagues found a similar pattern of results using real-life high-stakes deception. When coding videos, they report the presence of emotional cues in the faces of liars and truth-tellers (Porter & ten Brinke, 2008; Porter, ten Brinke, & Wallace, 2012); although, the cues were not veracity-specific, with cues occurring during truthful and deceptive statements, and the amount was so small as to make it trivial.

However, such results are rare, and seem to not reflect the overall trend in the literature. Meta-analyses investigating behavioral cues and deception detection report that emotional cues are not reliable predictors of deception (DePaulo et al., 2003), nor does the emotionality of the lie predict detectability (Hartwig & Bond, 2014). Thus, from a diagnosticity perspective, emotional cues may not be the optimal approach for improving deception detection.

Veracity judgments

The present focus is on the role of emotion recognition and emotional cues on decoder veracity judgments (i.e. humans, unaided by technology, classifying a statement as deceptive or honest).

One area of research which initially seems to lend credence to the importance of emotional cues is the emotion recognition literature. Here, researchers find that people give preferential attention to faces (Fernández-Dols, Wallbott, & Sanchez, 1991), and facial expressions receive preferential processing in the brain (Vuilleumier, Armony, Driver, & Dolan, 2001). Importantly, people can reliably classify facial expression of emotions with high accuracy (>70%; Ekman, 2003b; Nelson & Russell, 2013). Thus, people possess the ability to perceive emotional cues and infer others' affective states. Taken with the above studies showing support for emotional cues being useful in classifying veracity would suggest the EBA as having merit. However, when consider emotional cues usage for veracity judgments, the pattern of results reported by the EBA changes considerably. The studies which reported positive associations between emotional cues and classification accuracy (through video coding), fail to find the same results when considering human decoders. Frank and Ekman (1997), reported in their second study that unaided decoders on the same mock crime videos could not detect veracity above chance performance (50%), as did Porter and colleagues (2012) for their real-life high-stakes videos. Thus, even if differences in cues between veracities exist, without the use of technology (e.g., frame-by-frame coding) it would appear that people do not or cannot incorporate emotional information in their judgments to improve classification accuracy.

Connecting back to the emotion recognition literature, research has shown that people make quick inferences regarding others based on their facial expressions, even briefly presented (Willis & Todorov, 2006), however, and more importantly, they are not accurate at determining if the emotions decoded are genuine or fabricated (Krumhuber, Likowski, & Weyers, 2014; Zloteanu, Krumhuber, & Richardson, 2018). Given that people prefer, focus on, and assign more weight to nonverbal information when making judgments about others, a picture starts to emerge where emotional cues are less a tool for detecting deception and more a source for potential bias and inaccuracy (Bond, Howard, Hutchison, & Masip, 2013).

Present research

The current research explores the role of emotion recognition and emotional cues on decoder veracity judgments. Several assumptions of the EBA were investigated. First, the argument that more perceptive decoders are better at detecting deception. Second, that training in emotional cues can aid deception detection. Third, that accuracy for detecting deception is higher if the lies contain an emotional element.

Study 1

We first explored the primary assumption of the EBA: the relationship between human lie detection ability (i.e. real-time detection, unaided by technology) and emotion recognition ability (i.e. perceiving and interpreting emotional information from others' behavior). Two components of the emotion recognition construct were considered: facial expression recognition and empathy.

Facial expression of emotions

Two types of facial expressions proposed by the EBA as relevant to detecting deception were examined: microexpressions and subtle expressions.

Microexpressions are full-faced expressions occurring at <0.5 of a second, resulting from failed attempts to mask or suppress one's true emotions (Ekman, 2003a; Frank & Svetieva, 2015). The reliance on microexpression for cues to detecting deception is a highly controversial stance (see Burgoon, 2018). While these have been documented in both laboratory (e.g., Ekman & Friesen, 1969) and real-world scenarios (e.g., Porter & ten Brinke, 2008), research has not found a consistent relationship with deception detection.

Subtle expressions are partial expressions of suppressed or masked affect, displayed with only fragments of the prototypical expression musculature. Unlike microexpressions their presentation is longer in duration, but, they are also more ambiguous (Ekman, 2003a; Matsumoto & Hwang, 2011). While few studies have researched subtle expressions, evidence suggests that their recognition does relate to veracity judgments (e.g., Matsumoto, Hwang, Skinner, & Frank, 2014; Warren, Schertler, & Bull, 2009).

Empathy

The second component considered is empathy: the ability to accurately perceive and interpret the emotions of others (Singer, 2006). Empathy is considered necessary for social communication, predicting behavior, and the accurate identification of emotional cues (Keysers, 2012). Specifically, empathy relates to the accurate recognition of facial expressions (Besel & Yuille, 2010), even subliminally presented (Prochnow et al., 2013), and can aid the detection of mismatched emotions (Wojciechowski, Stolarski, & Matthews, 2014); all aspects underlying the EBA.

Research on the relationship of empathy and deception detection is scarce. While some suggest that being more empathic relates to better emotional cue classification (Svetieva & Frank, 2016), it also relates to poorer veracity judgments (Baker, ten Brinke, & Porter, 2013; Israel, Hart, & Winter, 2014). This may reflect more recent interpretations of empathy, suggesting it relates to emotion classification but not to affective authenticity discrimination. For instance, DesJardins and Hodges (2015) investigated deception detection and empathic accuracy[1], finding that while decoders were more accurate at inferring the thoughts of their conversation partners when these were being honest, they were not better when these were lying. Empathy may therefore be useful for correctly inferring others' affective states only when the emotional cues displayed are genuine.

At present, we predicted that emotion recognition hinders lie detection performance. Being able to recognize the emotions of another is only useful in predicting affect if the emotional cues being decoded are genuine, not deceptive. Hence, more emotionally perceptive decoders relying on such cues may be more likely to misinterpret the sender's true affective state if the cues produced are deceptive, leading to poorer deception detection (see

[1] DesJardins and Hodges did not measure empathy explicitly, but simply compared the ability of interactive partners to match their perception of a scenario with the intention of their partner.

Zloteanu, 2015).

Method

Participants

Based on estimates from the existing literature, an *a priori* power analysis was conducted (G*Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007) to determine the sample size necessary to have an 80% power of detecting a moderate (ρ = 0.5) size correlation, at the traditional .05 criterion of statistical significance (two-tailed). 42 participants (26 females, M_{Age} = 23.7, *SD* = 9.7), were recruited using the university's online subject pool. Participants received course credit or £1 for their time. Informed consent was obtained from all participants and all aspects of the experiment were approved by the university's ethics committee.

Stimuli and materials

Empathy. Individual differences in empathy were measured using the Interpersonal Reactivity Index (IRI; Davis, 1983). This multidimensional measure consists of 28 questions, 7 questions specific to each of the four subscales, Perspective-taking, Fantasy, Empathic Concern, and Personal Distress, to which individuals respond using a letter from A *(does not describe me well)* to E *(describes me very well)*. The IRI has high internal and external validity (Davis & Franzoi, 1991), and good test-retest reliability (Davis, 1983).

Facial expression recognition. The Micro Expression Training Tool (METT; Ekman, 2002) was developed to train microexpression recognition for seven basic emotions: happiness, anger, sadness, disgust, fear, surprise, and contempt. The software's "Pre-test" module was used, consisting of 14 color portrait photographs of facial expressions of emotions (Japanese and Caucasians), two for each emotion. The maximum score is 100%. The METT has been used in past studies (e.g., Frank & Ekman, 1997; Warren et al., 2009), and is based on the Brief Affect Recognition Test which has good validity and reliability

(Matsumoto et al., 2000).

The Subtle Expression Training Tool (SETT; Ekman, 2002) is intended to train the recognition of subtle expressions. The “Practice” module was used, which offers a test of subtle expression recognition, providing a percentage score at the end. The task contains 37 expressions, belonging to seven basic emotions. All expressions are presented using the same Caucasian female, in black and white. The speed of presentation of the expressions is set at the start, 1 *(slowest)* to 6 *(fastest)*; the setting of 3 was used.

Videos. Twenty videos (10 lies) were selected from the Bloomsbury Deception Set (Street et al., 2011). Senders in the videos are describing past vacations, where half of the senders are lying (i.e. fabricating a holiday). The videos contain naturalistic lies, as the senders were not given any incentive to deceive other than being asked to help with a travel documentary. The videos were gender-matched for each veracity and presented in a fixed order. All videos are around 30s.

Design and procedure

A within-subjects correlational design was employed. Participants were measured on their ability to detect truths and lies, their confidence for each veracity decision, trait empathy, subtle expression recognition, and microexpression recognition. Participants watched each video and made a veracity decision (forced choice: lie or truth), and provided their confidence on a 5-point scale ranging from “Not at all confident” to “Very confident”. Participants then completed the SETT and METT tasks (counterbalanced). The SETT provides ongoing feedback, and offers a “Try Again” feature if you respond incorrectly; participants were told to ignore this and progress to the next expression. The two test scores were recorded. They were then given the IRI. At the end, participants were debriefed.

Results

The data was initially screened. One data point was excluded from all subsequent analyses, using Cook's distance with a cut-off criterion of 0.5. The final sample was $N = 41$ (26 females).

Deception detection accuracy

Overall performance on the deception detection task was 55% ($SD = 2.10$), which is significantly different from chance accuracy (50%), $t(40) = 3.04$, $p = .004$, 95% CI [.33, 1.62], $d = 0.48$, JZS $BF_{10} = 8.61$. Considering each veracity, truth accuracy was 62% ($SD = 1.46$) and significantly above chance, $t(40) = 5.36$, $p < .001$, 95% CI [.76, 1.68], $d = 0.84$, JZS $BF_{10} = 4913.52$, while lie accuracy was 48% ($SD = 1.42$) and was not different from chance, $t(40) = 1.09$, $p = .281$, 95% CI [-.70, .21], JZS $BF_{10} = 0.29$; the performance differences between veracities was statistically significant, $t(40) = 4.63$, $p < .001$, 95% CI [.82, 2.10], $d = 0.72$, JZS $BF_{10} = 574.20$. A Pearson's correlation between accuracy and judgment confidence did not find a significant relationships, $r(41) = -.125$, $p = .440$, 95% CI [-.42, .19], JZS $BF_{10} = 0.26$.

Judgment bias

Participants' response bias was also considered. This reflects the total number of "truth" and "lie" judgments for the videos compared to the expected value given the base-rate. Each "truth" response was coded as +1, while each "lie" response was coded as -1, then summed across the videos. A positive score indicates a truth-bias, a score of 0 indicates no bias, while a negative score indicates a lie-bias. The analysis revealed that decoders were overall truth-biased in their veracity judgments (one-sample t-test), $t(40) = 4.63$, $p < .001$, 95% CI [1.65, 4.21], $d = 0.72$, JZS $BF_{10} = 574.20$.

Facial cue recognition

Participants were able to recognize microexpressions with 65.46% ($SD = 14.30\%$) accuracy and subtle expressions with 61.25% ($SD = 10.30\%$) accuracy. To assess whether deception detection performance was related to the ability to detect facial cues, METT and

SETT[2] scores were analyzed using Pearson's correlations against overall accuracy on the deception detection task, and subsequently with the truth and lie detection accuracies.

For the METT, neither overall accuracy, $r(41) = .002$, $p = .99$, 95% CI [-.31, .31], JZS $BF_{10} = 0.20$, nor truth, $r(41) = .072$, $p = .660$, 95% CI [-.24, .37], JZS $BF_{10} = 0.21$, or lie accuracy, $r(41) = -.070$, $p = .660$, 95% CI [-.37, .24], JZS $BF_{10} = 0.21$, were significantly correlated. Similarly, no significant correlations were found for the SETT scores and accuracy; either for overall, $r(40) = -.214$, $p = .190$, 95% CI [-.49, .11], JZS $BF_{10} = 0.46$, truth, $r(40) = -.194$, $p = .230$, 95% CI [-.48, .13], JZS $BF_{10} = 0.40$, or lie accuracy, $r(40) = -.108$, $p = .51$, 95% CI [-.42, .21], JZS $BF_{10} = 0.24$. SETT and METT scores also did not correlate, $r(40) = .102$, $p = .530$, 95% CI [-.22, .40], JZS $BF_{10} = 0.24$.

Empathy

Accuracy and empathy scores were significantly negatively correlated, $r(41) = -.382$, $p = .014$, 95% CI [-.62, -.08], JZS $BF_{10} = 3.40$. Planned correlations for each veracity score with empathy revealed the predicted negative correlation between lie detection accuracy and empathy, $r(41) = -.362$, $p = .010$ (one-tail), 95% CI [-.60, -.06], JZS $BF_{10} = 2.80$, but no positive correlation between truth detection accuracy and empathy, $r(41) = -.183$, $p = .130$ (one-tail), 95% CI [-.47, .13], JZS $BF_{10} = 0.38$.

The potential relationship between empathy and bias was also investigated, but was found be non-significant, $r(41) = .123$, $p = .440$, 95% CI [-.19, .42], JZS $BF_{10} = 0.26$. Similarly, the relationship between empathy and confidence was not significant, $r(41) = .065$, $p = .690$, 95% CI [-.25, .37], JZS $BF_{10} = 0.21$.

Finally, empathy did not correlate with either microexpression recognition, $r(41) = .237$, $p = .136$, 95% CI [-.08, .51], JZS $BF_{10} = 0.57$, or subtle expression recognition, $r(40)$

[2] Due to incomplete data, one participant was removed from the SETT analyses. The sample for these analyses is $N = 40$ (14 males).

= .094, p = .566, 95% CI [-.23, .39], JZS BF_{10} = 0.23. Considering empathy as a potential mediator for the facial cue recognition and accuracy relationship did not provide any further insights, as neither the direct, b = .015, $t(40)$ = .63, p = .532, or indirect effect, b = .001, $t(40)$ = .011, p = .991, were statistically significant.

Discussion

The study uncovered the predicted negative relationship between empathy and the ability to detect deceptive statements. No relationship between facial cue detection and accuracy was found, although, decoders were able to accurately classify microexpressions and subtle expressions with high accuracy (~63%; where chance accuracy is 14.3%).

The negative relationship between empathy and lie detection suggests that being more attuned to the emotions of others is detrimental to discerning veracity. From the data, we see that empathy was not related to a systematic response tendency (i.e. bias), suggesting the finding is not explained by empathic decoders being more inclined to simply believe that deceptive statements are genuine (i.e. gullibility). This result is in line with our assumption that high empathics may be misinterpreting deceptive emotional cues as reflecting the sender's genuine affect, impacting their decision-making and leading to poorer lie detection.

Consequently, emotional information may have a different role for individuals in deceptive interactions compared to genuine interactions. In genuine interactions, being suspicious and doubtful can negatively impact on relationship outcomes (McCornack & Levine, 1990), whereas the role of empathy may be to foster successful genuine interactions. Conversely, in deceptive scenarios, being more empathic can be detrimental as the desire to engage in such successful social exchanges may supersede the judging of emotional authenticity. Thus, empathy may aid decoders in answering the question "what emotion is the sender trying to convey?" but not "does the sender's displayed emotion match their underlying affect?".

Study 2

Expanding on the above findings, we investigated two additional assumptions of the EBA: (1) that low accuracy is attributed to the type of lie decoders see, and (2) that training in facial cue recognition aids deception detection. The experiment also addresses the scarcity of decoder comparison on multiple deception scenarios.

Emotion recognition training

The allure of the EBA is the supposed universality of emotional cues (Ekman, 2003a; cf. Barrett, 2011). If emotional cues generalize to all deceptive situations, then training decoders to detect them can improve their lie-catching ability (Ekman, 2009). This assertion has been bolstered by findings that micro- and subtle expressions identification can improve with training (Ekman & Friesen, 1974; Hurley, 2012; Matsumoto & Hwang, 2011), and that deception detection training containing information about classifying emotions shows positive effects on accuracy (Ekman, O'Sullivan, Friesen, & Scherer, 1991; Frank & Ekman, 1997; Shaw, Porter, & ten Brinke, 2013). However, such results are rare in the literature and seem to not generalize to all types of deception (Matsumoto et al., 2014).

While the effects of training on deception detection accuracy are still debated (Driskell, 2012; Hauch, Sporer, Michael, & Meissner, 2014; Kassin & Fong, 1999), there is evidence for unwanted side-effects from such interventions. One such effect is increasing confidence in one's veracity decisions (DePaulo & Pfeifer, 1986), which can have severe consequences (see Weinberger, 2010). Another side-effect of training is reducing or reversing decoders' truth-bias towards more readily assuming others are lying (i.e. lie-bias; Masip, Alonso, Garrido, & Herrero, 2009). It is also argued that any beneficial effects of training may simply occur due to attentional changes brought about by the nature of the task, having little to do with accurately applying specific knowledge (DePaulo, Lassiter, & Stone, 1982; Levine, Feeley, McCornack, Hughes, & Harms, 2005).

Investigating the usefulness of emotion recognition training has relevance for our theoretical understanding and for informing real-world applications (see Inbau, Reid, Buckley, & Jayne, 2011; Owayjan, Kashour, Haddad, Fadel, & Souki, 2012). For example, the Transportation Security Administration in the USA has made substantial financial contributions to developing and utilizing the Screening Passengers by Observation Techniques (SPOT) approach, which includes microexpression detection (Weinberger, 2010).

Lie type

The EBA considers that the type of lie decoded can influence detection performance. For instance, high-stakes lies— where the reward to the liar for escaping detection or the punishment for being caught are severe—should be easier to detect due to the more intense emotions the liar experiences (Frank & Ekman, 1997), making controlling one's channels of communication more difficult (DePaulo & Kirkendol, 1989). The added stakes should produce more frequent and pronounced behavioral differences between liars and truth-tellers.

When considering veracity judgments, some researcher do report that decoders accuracy is influenced by both the amount and types of cues (not limited to emotional cues; Granhag & Strömwall, 2001). Furthermore, research on emotion recognition ability finds that people show stable performance when decoding nonverbal cues (Schlegel, Boone, & Hall, 2017), and those with higher accuracy report relying on facial expressions for their judgments (Warren et al., 2009). However, aside from individual findings, the literature has not supported the role of lie type and emotional content of the lie on the detectability of deception. Two meta-analyses failed to find stakes to moderate detectability (Driskell, 2012; Hauch et al., 2014), while Hartwig and Bond, (2014) in their meta-analysis found that the emotional content of lies does not affect accuracy.

Adding further complexity, the stability of human lie detection performance across scenarios is still debated, where some researchers find that decoder performance is stable

(Frank & Ekman, 1997) while others do not (Vrij, Mann, Robbins, & Robinson, 2006).

To account for this fact, multiple video sets were used, containing different types of lie for decoders to detect. The first set contained naturalistic, unmotivated lies told by individuals assisting with a travel documentary (see Study 1). These represent experiential lies that one may encounter in daily life, where the sender is telling a story relating to a past event that may or may have not happened. The second set contains lies related to an emotionally charged event the sender is experiencing, where s/he is either retelling or fabricating their affective experience (see stimuli section and Warren et al., 2009). These videos can be divided into two subsets: emotional or unemotional. If the sender is lying about experiencing an affective event when in reality their experience is neutral, it is referred to as an unemotional lie (i.e. they are fabricating an emotion). If the sender is lying about experiencing a neutral event when they are experiencing an affective event it is referred to as an emotional lie (i.e. they are suppressing an emotion).

Utilizing multiple lie scenarios allows for an exploration of how decoders' veracity judgment change as the product of the type of lie they decoder, as well as the stability of their ability across lie scenarios (O'Sullivan, Frank, Hurley, & Tiwana, 2009). Namely, for decoders relying more on emotional cues for their performance may be better/worse overall or they may demonstrate lie-type-specific differences.

We manipulated decoders' ability to recognize emotional cues by providing emotion recognition training which we compared to receiving bogus training or no training. We hypothesized that receiving emotion recognition training (real or bogus) would result in (1) differences in veracity judgments and confidence, as compared to receiving no training and (2) that decoders' performance would differ based on the type of lie decoded.

Method

Participants

One hundred and six participants (84 females; M_{Age} = 20.9, *SD* = 4.7), were recruited through the university's online subject pool. An *a priori* power analysis for an interaction between training condition (3), veracity (2), and lie type (2), assuming a medium-sized effect (Cohen's *f* = 0.18), determined that this sample size would be sufficient for 80% power. Participants received course credits for participating. Informed consent was obtained from all participants. Ethical approval was granted by the university's ethics committee.

Stimuli and materials

Videos. 20 videos (10 lies) were selected from the BDS. The lies told by senders refer to an experiential episode (a past real or fabricated vacation). As the senders were given no incentive to lie, it can be assumed that the stakes and motivations to lie were low. The videos were controlled for gender in each veracity and were presented in a fixed order.

The 20 videos (10 lies) from Warren et al. (2009) were used. Senders watched a Hawaiian landscape footage or a surgical procedure (in counterbalanced order), used to induce mildly positive or severely negative affective responses, respectively. When lying, senders were instructed to describe what they saw as if it were the opposite video. For their second recording, the senders watched the remaining video and described it truthfully. The senders also initially recorded a brief (30s) description of their hobbies or interests, serving as a baseline of their behavior. The two subsets of the affective videos were also considered. These are the emotional set (5 lies, 5 truths), where the sender watched the surgical videos, and unemotional set (5 lies, 5 truths), where the sender watched the pleasant beach scene. All senders were told that "their performance would be judged" and if successful in their deception they "would win £10" (Warren et al., 2009, p. 62), adding additional motivation and incentive for senders to be believed. The final videos are approximately 1 minute in length, each containing a baseline and either a deceptive or truthful statement. The videos selected were controlled to not contain the same sender twice.

Emotion recognition training. The training program was constructed using the training and practice modules of the METT and the SETT. The METT's training module contains 4 videos describing the seven basic facial expressions; it provides distinctions between expressions, and explains their correct interpretation. The practice module contains 28 microexpressions, to which users respond by selecting one of the seven emotion labels. If they make an incorrect choice, they can choose to reveal the expression and its correct emotion. The user decides at which rate they progress through these faces. The SETT's training module shows multiple subtle expressions of the seven basic emotions with written explanations for their interpretation. The user decides the progression rate through each emotion. The practice module offers a recognition test with 37 expressions briefly presented at a predetermined speed; the slowest speed was used to give participants time to fully understand the expressions. Participants were also allowed to use a "Try again" function if they identified an expression incorrectly.

Design and procedure

A three-way mixed design was employed. The between-subject variable was Training (emotion recognition training, bogus training, and no training), while the within-subjects variables were Veracity (lie and truth), and Lie-type (experiential and affective). The dependent variables were accuracy, confidence, and response bias. Participants were randomly assigned to one of the three categories: emotion recognition training (ERT; n = 39), bogus training (BT; n = 38), and no training (NT; n = 29).

In the ERT condition participants were given the emotion recognition training. They were allowed to progress through each component of the training at their own pace. The two video tasks were then presented (counterbalanced). For each video they were asked to state their veracity decision (forced choice: lie or truth), and their confidence using a 5-point Likert-type scale. The procedure took around 65 minutes to complete.

In the BT condition, participants received a fake training program containing no actual cues of deception or emotion. The program was created using the neutral expressions of the METT practice module. Participants were told that the task trains them to "spot subtle differences in the face, which translate to spotting cues of deception". They were shown a fixation cross, followed by a face, which stayed on screen for a predetermined amount of time, then replaced with a fixation cross followed by a multiple-choice question. There were three blocks with different presentation times: slow (1s), medium (.75s), and fast (.5s). There were 18 faces in each block, controlled for gender. The questions regarded the age, eye color, hair color, and facial feature of the person in the photo. For each question they were give a multiple-choice answer with four possible responses, for example "What was the person's eye color?" with the possible answers being "A. Blue, B. Green, C. Brown, D. Black". The bogus training was created in Matlab (R2012b, v8.0). Afterwards, participants were given the video sets. The procedure took around 45 minutes.

In the NT condition participants were directly given the video tasks and asked to provide veracity and confidence responses. The procedure lasted around 35 minutes.

Participants in the ERT and BT conditions were also asked about the perceived effectiveness of the training, posed as "How effective was the training program?" to which they responded using a number from 1 *(Not at all Effective)* to 5 *(Extremely Effective)*.

Results

Participant veracity responses were analyzed to form two variables: accuracy and response bias. Accuracy was calculated by matching the veracity of the videos with the response participants gave (coded as "correct" or "incorrect"). This was then summed for each veracity and lie-type condition forming a percentage accuracy score; for a detailed discussion on the importance of treating each veracity score separately, see Levine et al. (1999). To assess response bias, the veracity responses of participants were calculated as described in Study 1.

Accuracy

Overall deception detection accuracy was 55.35% for the Experiential videos and 44.6% for the Affective videos. To consider how the type of lie participants saw may have affected their veracity judgments, an analysis considering training and lie-type was conducted based on veracity. A manipulation check revealed no difference in perceived training effectiveness between the ERT and BT conditions, $t(75) = -.241$, $p = .81$, 95% CI [-0.31, 0.24], JZS $BF_{10} = 0.24$.

The results revealed a main effect of lie-type, $F(1,103) = 41.41$, $p < .001$, $\eta_p^2 = .287$, 90% CI [0.17, 0.39], JZS $BF_{10} = 5.8e^8$, with higher accuracy for Experiential videos (M = 55.33%, SD = 12.48%) than Affective videos (M = 44.58% , SD = 10.12%), and a main effect of Veracity, $F(1,103) = 66.73$, $p < .001$, $\eta_p^2 = .393$, 90% CI [0.27, 0.50], JZS $BF_{10} = 1.3e^{11}$, where overall truths (M = 55.94%, SD = 15.23%) were easier to detect than lies (M = 44.62%, SD = 15.59%). There was no effect of Training on accuracy, $F(2,103) = 1.05$, $p = .354$, JZS $BF_{10} = 0.10$. The interaction between Lie-Type and Veracity was found to be statistically significant, $F(1,103) = 16.37$, $p < .001$, $\eta_p^2 = .137$, 90% CI [0.05, 0.24], JZS $BF_{10} = 305.17$; no other interaction term was statistically significant, Fs < .929, ps > .398, JZS $BF_{10} < 0.12$.

The Lie-type X Veracity interaction was unpacked, first considering differences based on Lie-type. Simple effects revealed a statistically significant difference in truth detection, $F(1,103) = 59.64$, $p < .001$, $\eta_p^2 = .367$, 90% CI [0.25, 0.47], JZS $BF_{10} = 1.2e^{11}$, with higher accuracy for Experiential videos (M = 63.9%, SD = 16.8%) compared to Affective videos (M = 48%, SD = 13.6%). Similarity, a significant effect for lie detection, $F(1,103) = 4.00$, $p = .048$, $\eta_p^2 = .037$, 90% CI [0.00, 0.11], JZS $BF_{10} = 1.37$, with Experiential videos (M = 46.8%, SD = 15.4%) being easier to detect than Affective videos (M = 42.5%, SD = 15.8%).

Considering Veracity, simple effects revealed a statistically significant difference between truths and lies for Experiential videos, $F(1,103) = 71.43$, $p < .001$, $\eta_p^2 = .419$, 90% CI [0.29, 0.50], JZS $BF_{10} = 2.0e^{12}$; Lies were harder to detect ($M = 46.8\%$, $SD = 15.4\%$) than Truths ($M = 63.9\%$, $SD = 16.8\%$). Similarly, a veracity difference was seen for Affective videos, $F(1,103) = 7.45$, $p = .007$, $\eta_p^2 = .069$, 90% CI [0.01, 0.16], JZS $BF_{10} = 8.89$, with Lies ($M = 42.5\%$, $SD = 15.8\%$) being harder to detect than Truths ($M = 48\%$, $SD = 13.6\%$). See Figure 1.

---Approx. position of Figure 1---

Affective subsets: Emotional vs. unemotional.

The accuracy difference between the two subsets of the Affective videos was also investigated. A three-way analysis was performed on the affective emotional (AE) and affective unemotional (AU) video subsets, to account for the type of emotion decoders saw. The results of the ANOVA revealed that the type of lie told had a significant effect on accuracy, $F(1,102) = 119.23$, $p < .001$, $\eta_p^2 = .539$, 90% CI [0.52, 0.69], JZS $BF_{10} = 5.4e^{27}$, with AE videos showing higher accuracy ($M = 57.4\%$, $SD = 16.5\%$) than AU videos ($M = 31.9\%$, $SD = 12.9\%$). A main effect of Veracity was also observed, $F(1,102) = 57.98$, p $< .001$, $\eta_p^2 = .297$, 90% CI [0.18, 0.40], JZS $BF_{10} = 3.1e^{10}$, where truths were detected with higher accuracy ($M = 52.4\%$, $SD = 20.5\%$) than lies ($M = 37.0\%$, $SD = 21.9\%$). No effect of training or interaction was found to be statistically significant, Fs ≤ 2.25, ps $\geq .111$, JZS $BF_{10} < 0.9$.

Confidence

An analysis considering the effect of Training and Lie-Type on confidence was conducted. This revealed a main effect of Lie-Type on confidence ratings, $F(1,103) = 6.16$, p

= .015, η_p^2 = .056, 90% CI [0.01, 0.14], JZS BF_{10} = 1.78, but no main effect of Training, *F* < 1, *p* = .579, JZS BF_{10} = 0.25. The interaction term was statistically significant, *F*(2,103) = 4.01, *p* = .021, η_p^2 = .072, 90% CI [0.00, 0.11], JZS BF_{10} = 2.33.

Simple main effects were conducted to unpack the interaction. Considering Lie-Type, a difference in confidence ratings was found between Experiential (*M* = 63.41, *SD* = 8.31) and Affective (*M* = 67.13, *SD* = 8.01) videos in the ERT group, *F*(1,103) = 10.85, *p* = .002, η_p^2 = .095, 90% CI [0.02, 0.19], JZS BF_{10} = 15.20. Similarly, a difference was found between Experiential (*M* = 61.97, *SD* = 10.30) and Affective (*M* = 65.07, *SD* = 10.11) videos in the Control group, *F*(1,103) = 5.38 *p* = .028, η_p^2 = .050, 90% CI [0.00, 0.13], JZS BF_{10} = 2.06. No effect was found for the BT group, *F* < 1, *p* = .483, JZS BF_{10} = 0.29. When considering the interaction based on Training, no differences were found for either video set, *F*s ≤ 1.85, *p*s ≥ .163, JZS BF_{10} < 0.39.

Bias

Investigating the effect of training on response bias did not reveal an effect of Training or Lie-Type, *F*s < 1, *p*s ≥ .431, JZS BF_{10} < 0.18, or interaction, *F*(1, 103) = 1.59, *p* = .210, JZS BF_{10} = 0.30. Participants were overall truth-biased in their responses towards both the Experiential videos (*M* = 3.41, *SD* = 4.09), *t*(105) = 8.61, *p* < .001, 95% CI [2.63, 4.20], *d* = 1.67, JZS BF_{10} = $3.0e^{10}$, and the Affective videos (*M* = 3.08, *SD* = 5.38), *t*(105) = 5.88, *p* < .001, 95% CI [2.04, 4.11], *d* = 1.15, JZS BF_{10} = $2.4e^{5}$.

Discussion

Study 2 tested the effect of emotion recognition training on decoders' veracity judgments. The results found no effect of receiving training—real or bogus—on veracity judgments compared to no training. This conforms with the literature suggesting that having decoders focus on emotional information is not an optimal strategy (Burgoon, 2018; Hartwig & Bond, 2014). While accuracy was not improved, the lack of a reduction in accuracy resulting from training is also noteworthy, as past training interventions have also been shown to produce negative outcomes (Levine, 2014). A more surprising finding is that training did not impact on decoders' confidence, although a positive trend was observed. Typically, research finds that training bolsters people's already high confidence (DePaulo & Pfeifer, 1986). Perhaps the detection task was considered difficult and training did not ease the process sufficiently, tempering confidence. Finally, decoders were found to be overall truth-biased in their responses, as observed in the majority of past research (Levine et al., 1999). However, decoders remained truth-biased in all training conditions, contrasting past findings of training reversing decoder bias (Kim & Levine, 2011).

The current use of multiple types of lies provided a direct comparison of decoders' veracity judgments across situations. When comparing detection rates, it was found that accuracy for experiential lies was higher to that of affective lies. The easier detection of the experiential lies may be attributable to the fact that the lies told in the affective videos are practically identical (i.e. a lie about either the surgery or the beach scene), only the sender changes. By contrast, the experiential videos contain unique lies on a similar theme; the additional information contained in these stories may have led to the increase in accuracy. However, when considering affective emotional and unemotional lies, differences also emerged. Emotional lies were easier to detect than their unemotional counterpart, showing support for emotionality affecting the detectability of deception (cf. Hartwig & Bond, 2014). Overall, the results provide an interesting look at how lie type can affect decoder veracity judgment.

A few limitations of the current design need mentioning. First, while we consider the METT and SETT to have acted as emotion recognition training, there was no direct post-training measure for classification scores. As such, we cannot assess the impact of the ERT on recognition rates; this also does not allow us to analyze relationships between the ERT tasks and lie types (e.g., the relationship between SETT scores and emotional lie detection reported in Warren et al., 2009). Indirectly, support for such training can be inferred from studies utilizing these tools findings reliable effects (e.g., Hurley, 2012; Matsumoto & Hwang, 2011). Second, the videos themselves were not coded for the presence of emotional cues, nor did we question the participants after the fact to uncover if they did rely on such information; although, people rarely provide accurate insight into their decision-making process.

General Discussion

At present, the role that emotions have on decoders' veracity judgments was considered. We investigated how decoders may be influenced by either differences in their ability to perceive and understand the emotional displays of others and by their knowledge of emotional cues.

Study 1 investigated the relationship between individuals' emotion recognition ability and deception detection accuracy. An alternative hypothesis to the EBA's suggested positive relationship was put forward: emotion recognition can result in poorer deception detection. Indeed, the negative correlation between accuracy and empathy suggests that having high empathy is detrimental to veracity judgments, potentially due to the misinterpretation of deceptive emotions as being genuine (e.g., Baker et al., 2013; DesJardins & Hodges, 2015; Israel et al., 2014). Alternatively, less empathic individuals may have an advantage in determining veracity, as they potentially utilize cues, weigh information, and/or judge statements differently, leading to better accuracy (e.g., rely more on content). It was also found that accuracy for detecting subtle and micro expressions was generally high among decoders, suggesting people are capable of accurately perceiving and interpreting such brief cues, but this was unrelated to deception detection accuracy.

A speculative explanation for how empathy and emotion recognition are linked to veracity judgments comes from work on embodied cognition. It has been argued that decoders understand the affective state of others by automatically simulating their expressions (Niedenthal, Mermillod, Maringer, & Hess, 2010). The sender's facial expression triggers the same facial configuration in the observer (i.e. facial mimicry; Hess & Fischer, 2013), inducing the same emotion (i.e. emotional contagion; Mafessoni & Lachmann, 2019). These models posit that the differences behind genuine and deceptive expressions should produce different activation in the mimicker (i.e. reliable muscle activation). However, this is only valid if there are perceptual differences between genuine and deceptive expressions, which seems to not be the case (Krumhuber & Manstead, 2009), nor do decoders seem capable of discriminating emotion authenticity (Zloteanu et al., 2018). Liars may be able to produce deceptive emotional displays that are "good enough" to activate the genuine embodied simulation in decoders, misleading them to infer this reflects the sender's underlying affect.

Considering the role of empathy, this may simply lower the threshold for classifying emotional cues as reflecting a specific emotion. Research finds that empathy relates more to the speed of facial processing, than to the accurate classification of emotions (Kosonogov, Titova, & Vorobyeva, 2015). In a non-deceptive scenario, this may result in more successful social interactions, as empathic decoders are quicker to react to the emotional state of others (Jani, Blane, & Mercer, 2012), however, in deceptive scenarios empathy may impede accuracy, as decoders are less critical of emotional information, resulting in the misinterpretation of emotional cues (Stel & Vonk, 2009).

When considering decoder's knowledge of emotional cues, Study 2 found that even manipulating emotion recognition ability, by providing facial cue detection training, does not aid deception detection. This finding has important outcomes, given that in forensic settings there exist training programs teaching emotional cues for lie detection purposes (e.g., Inbau et al., 2011). Several implications for this finding can be considered. First, as mentioned above, even if training improved decoders' classification accuracy (i.e. their ability to correctly label facial expressions of emotion; Matsumoto & Hwang, 2011), if they lack the ability to distinguish genuine and deceptive displays than training would not improve veracity judgments. Second, individuals may not be able to use the learned cues correctly, as these conflict with their unconscious heuristics and stereotypical knowledge of deception cues, meaning training is beneficial only if it coincides with decoders' preconceived notions (Forrest, Feldman, & Tyler, 2004). While the current findings do not exclude the possibility of other types of training aiding deception detection, they do not show support for the EBA's assumed relationship between emotion recognition and deception detection.

The data did show, however, that the affective emotional lies were easier to detect than the affective unemotional lies, replicating the findings of Warren et al. (2009). This would suggest that emotional content does impact on deception detection. At first glance, this difference seems at odds with the finding that ERT did not affect lie detection performance. To explain this, we must consider the type of emotions in each scenario. While the context for both AE and AU videos were identical, what differed was that senders in the AE condition were watching an emotion-evoking video while lying or telling the truth. Reclassifying the unemotional lie video as *deceptive emotional cues* (i.e. fabricated disgust), and the emotional lies videos as *genuine emotional cues* (i.e. leaked disgust) may explain the difference in accuracy. If decoders are poor at separating emotional cue authenticity, then being emotionally perceptive may be useful for detecting genuine emotions but detrimental when attempting to detect feigned (deceptive) emotions. This is supported by findings showing senders can produce genuine-looking emotional expressions (Krumhuber & Manstead, 2009), and that decoders a poor at separating expression authenticity (Zloteanu et al., 2018).

With regards to the difference in type of lie, the current paper illustrates the need for deception research to consider multiple lie scenarios on decoder performance. Interestingly, it was the experiential lies that were detected with higher accuracy than affective lies. This would indicate that other elements unrelated to the emotional content of the lie affects accurate veracity judgments. Here, as mentioned, the additional contextual information in the experiential videos may have been more beneficial to the decoding process. The issue of the reliability of results, and the generalizability of deception studies has been broached in the past, but it is one that is still not fully addressed. Having decoders judge various lie scenarios is clearly a benefit to deception research, as it allows for a more complex understanding of differences (e.g., overall accuracy) and similarities (e.g., veracity effects) in decoder performance across scenarios.

Taking the findings from the two studies together, the data support our assumptions that the ability to recognize emotional cues may not extend to processing the information into authentic or deceptive. We suggest that research on emotion recognition and deception must separate *classification accuracy* from *authenticity discrimination*. Decoders clearly use emotion-related information (diagnostic or otherwise) when making their veracity judgments, however, contrary to previous propositions, they do not seem to benefit directly from focusing on such cues.

The varied results reported in the literature relating to emotion recognition and deception detection may be partly due to the aggregation of the term "emotional cue". If decoders cannot separate *deceptive* from *genuine* emotional cues their ability to detect them will not relate with performance. As it stands, quite little is known about how people determine if an emotion is genuine or fabricated (Krumhuber et al., 2014). Failing to account for decoders' ability to separate emotional cues based on authenticity will produce further mixed results, reflecting more the stimuli utilized instead of training effectiveness or individual performance.

In conclusion, emotions play a complex role in deception detection. Facial cue detection was not found in any scenario to aid deception detection, while empathy negatively related to accurate veracity judgments. Training in emotion recognition did not produce an improvement in detection, for either experiential or affective lies, nor did it result in more biased or overconfident judgments. While the deception literature argues that lies told under emotionally charged scenarios are easier to detect, it was the experiential lies that had the highest accuracy. However, emotions clearly do influence detectability, as affective emotional lies were easier to classify than affective unemotional lies. The data suggest that decoders may struggle to utilize emotional information when making veracity judgments due to a difficulty in discriminating genuine from deceptive emotional cues.

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Figures

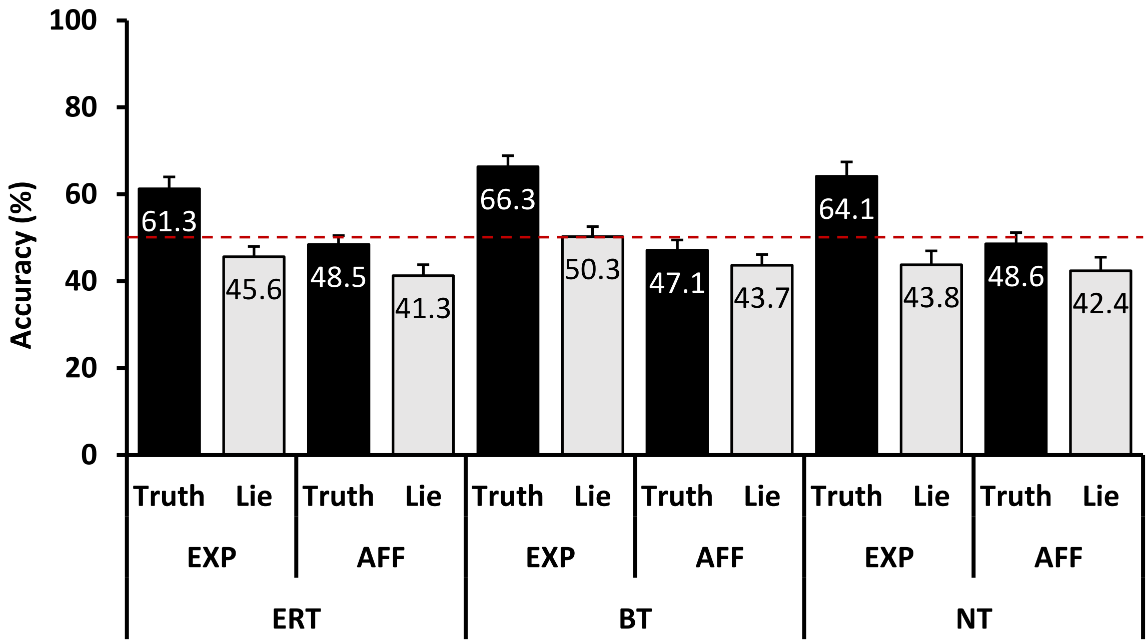

Figure 1. Mean accuracy (error bars ±1 SE) for emotion recognition training (ERT), bogus training (BT), and no training (NT) by video set, experiential (EXP) and affective (AFF), and veracity (Truth and Lie). the dashed line represents chance accuracy.