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When do we see that others misrepresent how they feel? detecting deception from emotional faces with direct and indirect measures

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ABSTRACT

Nonverbally-expressed emotions are not always linked to people's true emotions. We investigated whether observers' ability to distinguish trues from lies differs for positive and negative emotional expressions. Participants judged targets either simulating or truly experiencing positive or negative emotions. Deception detection was measured by participants' inference of the targets' emotions and their direct judgments of deception. Results of the direct measure showed that participants could not accurately distinguish between truth tellers and liars, regardless which emotion was expressed. As anticipated, the effects emerged on the indirect emotion measure: participants distinguished liars from truth tellers when inferring experienced emotions from negative emotional expressions, but not positive emotional expressions.

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Deception; facial expression; emotion; lying; nonverbal behavior

Nonverbally expressed emotions do not always reflect people's true emotions. People may simulate a smile when receiving a gift they are disappointed about. Bargainers may simulate anger to get what they want in a negotiation. Examples such as these indicate that people may deliberately and strategically try to influence others by misrepresenting their emotions (Li & Roloff, 2006). We investigated whether people are able to detect whether or not others deceive or truthfully show their emotions.

Detecting deception

Research on detecting deception indicates that people are generally not good in detecting deception; deception often remains undetected (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996) and when explicitly asked whether a person is deceiving or not, accuracy rates of detecting deception are not far above chance level (Bond & DePaulo, 2006; Vrij, 2000). Many explanations for the inability to detect lies have been suggested (e.g., Levine

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et al., 2011; O'Sullivan, 2003). One explanation is that people tend to believe rather than disbelieve information that is being presented (McCornack & Parks, 1986).

Research on nonverbal behavior adds another explanation for the inability to detect lies: People have inaccurate beliefs about cues to deception (Ekman, 2001; Vrij, 2000). Strömwall, Granhag, and Hartwig (2004) and Vrij (2008) conclude that people generally believe that liars show nervous behaviors, like excessive displays of movements, gaze aversion, smiles, and eye blinking. In reality, however, most liars show decreases in finger, hand, foot, and leg movements and use fewer illustrators than truth tellers (e.g., Vrij, 2000). In addition, gaze aversion, smiles, and eye blinking are not or only weakly related to deceptive behavior (DePaulo, 1988; Hartwig & Bond, 2011; Vrij, 2000). Another issue that laypeople are generally unaware of, is that facial expressions of emotional liars and truth tellers differ in the muscles that are activated and in the intensity, duration, laterality, and timing of this activation (Ekman, Hager, & Friesen, 1981; Hill & Craig, 2002).

The meta-analysis by Hartwig and Bond (2011) suggests, however, that failure to detect lies may not be caused by reliance on false beliefs about lying. Rather, people tend to rely on cues that weakly predict deception. Thus, Hartwig and Bond concluded that people are bad at detecting lies because of the weakness of behavioral cues to recognize a liar. In the present article, we examine whether people can correctly infer emotions from deceptive nonverbal emotional expressions, i.e., whether they can distinguish lies from truths when assessing emotions.

Detecting deception from emotional expressions

Evidence regarding the ability to distinguish between true and deceptive *positive* emotions is mixed. On the one hand, the emotional labor literature suggests that observers can distinguish smiles expressed while truly experiencing happiness from smiles expressed while not experiencing happiness. For instance, Groth, Hennig-Thurau, and Walsh (2009) showed that people who are required to smile a lot during service-related jobs are less positively evaluated when they engage in surface level acting (e.g., displaying a smile while not experiencing happiness) than when they engage in deep-level acting (i.e., attempting to generate happiness so that the displayed smile is real).

Comparably, people can distinguish between Duchenne and non-Duchenne smiles (e.g., Thibault, Gosselin, Brunel, & Hess, 2009). In addition to the activation of the zygomaticus major muscle which pulls up the lip corners, Duchenne smiles also include the activation of the orbicularis oculi which causes a contraction of the muscles at the corner of the eyes (Duchenne de Boulogne, 1990). Although Duchenne smiles are considered true signals of enjoyment, they can, however, also be displayed deliberately and without experiencing enjoyment. Krumhuber and colleagues (Krumhuber & Manstead, 2009; Krumhuber, Likowski, & Wyers, 2014) showed that people can only distinguish between Duchenne and non-Duchenne smiles when these are spontaneously displayed. Moreover, spontaneous smiles were only rated as more genuine than deliberate in the case of Duchenne smiles.

On the other hand, research on detecting true happiness has demonstrated that people do not perform above chance level when judging the veracity of spontaneous and deliberate smiles (e.g., Hess & Kleck, 1994). Moreover, when people are deceiving or telling the truth about experiencing positive emotions, observers cannot accurately distinguish between truly felt and simulated smiles (e.g., Ekman & O'Sullivan, 1991). So the results on the ability to

accurately distinguish true from deceptive positive emotional expressions seem mixed. The type of smiles studied in research on surface- and deep-level acting and on (non)Duchenne smiles is different from the type of true and false smiles studied in the deception literature. First, appearing friendly to others because a job requires one to do so is not identical to intentionally trying to mislead others. Second, although the (non)Duchenne smile studies provide insight into whether spontaneous and deliberate Duchenne or non-Duchenne smiles are regarded as more genuine, the research does not involve deception: Expressors of deliberate smiles are not asked to lie about their emotions, just to pose them. The research focusing directly on deception indicates that people are not able to accurately distinguish true and deceptive positive emotional expressions.

Few studies investigated whether observers are able to distinguish true from deceptive *negative* emotions. Porter and ten Brinke (2008) showed that deceivers show more inconsistencies when displaying deceptive negative emotions than deceptive positive emotions. Naive observers, however, did not perform above chance level when asked to judge the veracity of true and deceptive negative emotional expressions. This suggests that although deceivers are less successful in faking negative emotions, naive observers do not seem to notice.

It is conceivable, however, that when observers' attention would be more on these emotional deception cues, they could distinguish between liars and truth tellers. Shifting observers' focus to these emotional cues can be done by asking them to rate the extent to which a target actually experiences an emotion. The use of such an indirect measure to detect deception hardly leads to higher accuracy rates. Bond, Levine, and Hartwig (2015) showed in their meta-analysis that only 4 out of 24 indirect measures outperform direct measures (cooperative, thinking hard, indifferent, and audible immediacy). The 20 indirect measures that did not outperform direct measures include rating the pleasantness, expressiveness, and relaxation of the face, nervousness and friendliness. One explanation for why some indirect measures, but not others, outperform direct measures is that only indirect measures that focus observers' attention on deception cues that are useful can increase accuracy (Street & Richardson, 2015; Street & Vadillo, 2016).

An indirect measure asking to estimate the extent to which positive and negative emotions are experienced by expressors was not previously investigated. We argue that such an indirect measure enable observers to pick up on the fact that deceivers show more inconsistencies when expressing deceptive negative emotions than when expressing deceptive positive emotions (Porter & ten Brinke, 2008). Thus, we hypothesize that observers are better able to distinguish between deceptive and true negative emotional expressions than deceptive and true positive emotional expressions on an indirect emotion deception detecting measure. Furthermore, we anticipate that participants would be less able to accurately distinguish liars and truth tellers on a direct deception detecting measure, regardless which emotions are expressed.

To investigate our hypotheses, two studies were conducted in which participants watched video fragments of targets either lying or telling the truth about experiencing positive or negative emotions. We assessed people's ability to distinguish true emotional expressions from deceptive emotional expressions in two ways: directly, by asking participants to what extent they think that targets were telling the truth or lying, and indirectly by asking participants which specific emotions the targets experienced. As a within-subject design was used in both studies, Hedges's g_{av} is reported to correct for overestimation of effect sizes (Dunlap, Cortina, Vaslow, & Burke, 1996; Lakens, 2013).

Study 1

Method

Participants and design

Participants were 53 (38 women) students of Leiden University (M_{age} = 23.64, range: 18–51). They were randomly assigned to a 2 (deception condition: lie vs. truth) x 2 (expressed emotions: positive vs. negative) within-subjects design. They received 2 euros or credits for participation. Sample size was a result of terminating data collection after one week (as was decided beforehand).

Procedure

Participants watched eight video fragments, in which targets were lying or telling the truth (see Materials). After each fragment, participants responded on a 7-point scale whether they thought the target was telling the truth (direct measure; 1 = *not at all*, 7 = *very much*).[1] Then, participants estimated to what extent they thought the target experienced specific emotions while telling the story (indirect measurement). Thus, they were not asked to rate the displayed emotion; but how they thought the target actually felt. The emotions tense, enthusiastic, pleased, worried, irritated, angry, confused, cheerful, dreary, happy, sad, and mad were rated on a 7-point scale (1 = *not at all*, 7 = *very much*; Stel et al., 2010). Because the aim of the study was to examine whether people can correctly infer emotions from nonverbal behaviors the fragments were displayed without sound.

Materials

Targets were eight students (M_{age}: 20.00, range: 18–24). Only female targets participated because women are more expressive than men (e.g., Wagner, MacDonald, & Manstead, 1986). They received 2 euros or credits for participating. On the video a target expressed either true positive emotions, deceptive positive emotions, true negative emotions, or deceptive negative emotions. Before being recorded, the target watched either a positive film fragment (Jungle Book) or a negative fragment (Sophie's Choice). After watching the video, targets' positive and negative experienced emotions were measured by asking them to rate the extent to which they experienced 12 different emotions on a 7-point scale. Targets who watched the positive fragment felt more positive (M = 5.56, SD = 0.55) than negative (M = 2.53, SD = 0.56), while targets who watched the negative fragment felt more negative (M = 5.56, SD = 0.46) than positive (M = 1.19, SD = 0.38), $ps < .01$.[2]

Targets knew before the video that they were later asked to either lie or tell the truth. After the video, they received their instructions. Targets asked to tell the truth, were asked to tell the other participant (a naïve confederate) what they had just seen and how that made them feel. When asked to lie, they were asked to simulate positive emotions when they had seen the negative video and negative emotions when they had seen the positive video. Those who watched the positive fragment and were asked to lie, received a description of the negative fragment accompanied by a description of the emotions they would have experienced when watching this fragment. Those who watched the negative fragment and were asked to lie received a description of the positive fragment. All targets correctly carried out their lie or truth instructions.

Targets were told that the other participant was instructed to discover whether they were lying and it was their job to convince the participant of telling the truth. To raise the

Table 1. Means and standard deviations of participants' ratings of the targets' emotions by deception condition, expressed emotion and judged emotion of Study 1 (the higher the scores, the more attributed emotion 1 = totally not experienced, 7 = very much experienced).

		Deception condition			
		Lie		Truth	
Expressed emotion	Judged emotion	M	SD	M	SD
Positive	Positive	5.81_{a}	0.65	4.30_{b}	0.80
	Negative	1.65_{c}	0.54	2.65_{d}	0.82
Negative	Positive	3.13_{a}	0.76	3.13_{a}	0.90
	Negative	3.36_{a}	0.94	3.63_{b}	0.83

Notes: Means with noncommon subscripts differ significantly ($p < .05$) within each expressed emotion condition.

stakes, they were told that the ability to convince others (when lying and when telling the truth) is relevant to their career as a psychologist and is related to being successful (as in Ekman & Friesen, 1974).

During the conversation with the other participant, the targets' body and face were recorded with a camera hidden.[3] The first minute of each recording was selected. Afterwards, we explained our aim to create materials. We asked their permission to use their recordings for scientific studies.

Results and discussion

Indirect measure

A confirmatory principal components analysis on the judged emotion items[4] revealed a factor for negative emotions, consisting of tense, worried, irritated, angry, confused, dreary, sad, and mad ($\alpha = .90$). The second factor, positive emotions, consists of enthusiastic, pleased, cheerful, and happy ($\alpha = .90$). Means for each factor were calculated and used for further analyses.

To test the hypothesis that participants are better able to accurately distinguish liars from truth tellers when inferring emotions from negative expressions than from positive expressions, a 2 (deception condition: lie vs. truth) x 2 (expressed emotion: positive vs. negative) x 2 (judged emotion: positive vs. negative) within-subjects analysis of variance (ANOVA) was conducted (see Table 1 for means and contrast tests). Three significant main effects were found. First, the main effect for deception, $F(1, 52) = 4.05$, $p = .05$, $\eta_p^2 = .07$, Hedges's $g_{av} = 0.17$, indicated that participants rated liars ($M = 3.49$, SD = 0.29) as experiencing more intense emotions in general than truth tellers ($M = 3.43$, SD = 0.38). The main effect for expressed emotion, $F(1, 52) = 56.50$, $p < .001$, $\eta_p^2 = .52$, Hedges's $g_{av} = 0.79$, indicated that participants inferred more intense emotions when the expressed emotion was positive ($M = 3.60$, SD = 0.32) than when it was negative ($M = 3.32$, SD = 0.38). The main effect for judged emotion, $F(1, 52) = 102.61$, $p < .001$, $\eta_p^2 = .66$, Hedges's $g_{av} = 2.23$, showed that participants rated the targets as experiencing more positive ($M = 4.09$, SD = 0.53) than negative emotions ($M = 2.82$, SD = 0.59).

These effects were qualified by two-way interactions between deception condition and expressed emotion, $F(1, 52) = 35.66$, $p < .001$, $\eta_p^2 = .41$, deception condition and judged emotion, $F(1, 52) = 100.94$, $p < .001$, $\eta_p^2 = .66$, and expressed and judged emotion, $F(1, 52) = 298.65$, $p < .001$, $\eta_p^2 = .85$. These 2-way interactions in turn, were qualified by a three-way

Table 2. Means and standard deviations of participants' ratings of the targets' deception judgment by deception condition and expressed emotion of Study 1 (the higher the scores, the more deceitful, 1 = totally not deceitful, 7 = very much deceitful).

	Deception condition			
Expressed emotion	Lie		Truth	
	M	SD	M	SD
Positive	3.08_a	1.30	3.97_b	1.20
Negative	3.32_b	1.17	4.45_c	1.15

Note: Means with noncommon subscripts differ significantly ($p < .05$) within each column and row.

interaction between deception condition, expressed emotion, and judged emotion, $F(1, 52) = 48.19$, $p < .001$, $\eta_p^2 = .48$. To interpret this 3-way interaction, we conducted paired-samples t-tests for positive and negative expressed emotions.

Positive expressed emotions. When positive emotions were expressed, more positive emotions were inferred for targets lying that they felt positive ($M = 5.81$, SD = 0.65) than for targets telling the truth about feeling positive ($M = 4.30$, SD = 0.80), $t(52) = 13.78$, $p < .001$, Hedges's $g_{av} = -2.04$. Furthermore, more negative emotions were inferred for targets telling the truth about feeling positive ($M = 2.65$, SD = 0.82) than for targets lying that they felt positive ($M = 1.65$, SD = 0.54), $t(52) = 9.10$, $p < .001$, Hedges's $g_{av} = -1.42$. Thus, participants were unable to accurately distinguish true positive emotions from deceptive positive emotions.

Negative expressed emotions. When negative emotions were expressed, more negative emotions were inferred for targets telling the truth about feeling negative ($M = 3.63$, SD = 0.83) than for targets lying that they felt negative ($M = 3.36$, SD = 0.94), $t(52) = 2.41$, $p = .02$, Hedges's $g_{av} = 0.30$. Participants did not differ in their inferences of positive emotions for targets telling the truth about feeling negative ($M = 3.13$, SD = 0.90) and for targets lying that they felt negative ($M = 3.13$, SD = 0.76), $t(52) < 1$, $p = .97$, Hedges's $g_{av} = 0.00$. Thus, participants did not distinguish liars from truth tellers who displayed negative emotional expressions when inferring positive emotions, but were able to distinguish liars from truth tellers who displayed negative emotional expressions when inferring negative emotions.

Direct measure

To test the expectation that participants would not accurately distinguish liars from truth tellers on a direct measure, regardless which emotions are expressed, a 2 (deception condition) x 2 (expressed emotion) within-subjects ANOVA was conducted with the dependent variable being the reverse-coded answer on the direct measure (i.e., participants' inference that the target was telling the truth). Higher scores reflect more deception (see Table 2 for means and contrast tests). Two significant main effects were found. The main effect of deception condition, $F(1, 52) = 34.62$, $p < .001$, $\eta_p^2 = .40$, Hedges's $g_{av} = -1.07$, indicated that participants rated the targets who were telling the truth as more deceitful ($M = 4.21$, SD = 0.87) than those who were lying ($M = 3.20$, SD = 0.98). The main effect for expressed emotion, $F(1, 52) = 5.32$, $p = .03$, $\eta_p^2 = .09$, Hedges's $g_{av} = 0.40$, showed that participants rated targets who expressed negative emotions as more deceitful ($M = 3.89$, SD = 0.89) than

those who expressed positive emotions (M = 3.53, SD = 0.89). As expected, there was no interaction between deception condition and expressed emotion, $F < 1$, $\eta_p^2 = .01$. The effect size (Hedges's g_{av}) of the differences between liars and truth tellers for positive expressed emotions was −0.70 and for negative expressed emotions −0.96. Thus, participants made an inaccurate distinction between liars and truth tellers, regardless the expressed emotion: liars were rated as more truthful than truth tellers.

Study 2

Participants in Study 1 were more accurate in inferring deceptive and true negative emotional expressions than deceptive and true positive emotional expressions. This was found only when asking participants to infer negative emotions for liars and truth tellers, not when inferring positive emotions and not when they directly rated whether they thought the target was telling the truth. The aim of Study 2 was to replicate these findings. Also, we increased the number of fragments to increase generalizability of the results.

Method

Participants and design

Using snowball sampling, 80 (52 women, $M_{age:}$ 24.59, range: 18–63) students and nonstudents participated voluntarily. They were randomly assigned to the conditions of a 2 (deception condition: lie vs. truth) × 2 (expressed emotion: positive vs. negative) within-subjects design. Sample size was a result of terminating data collection after two weeks (as was decided beforehand).

Procedure

The procedure was similar to Study 1, except for a few changes. First, we added four video fragments to the fragments used in Study 1. So we had twelve different fragments in total, three of each category. Again, targets who watched the positive fragment felt more positive (M = 5.25, SD = 0.85) than negative (M = 2.15, SD = 0.74), while targets who watched the negative fragment felt more negative (M = 5.19, SD = 0.68) than positive (M = 1.46, SD = 0.60), ps < .001 (See note 2). Second, we extended our direct measure. In addition to rating to what extent they thought targets were telling the truth, participants now also rated to what extent they thought targets were lying (7-point scale, [1 = *not at all*, 7 = *very much*]. Third, we adjusted our indirect measure using more emotion items that are relevant to deception (i.e., frightened, fearful, anxious, nervous, penitential, regretful, guilty, repentant, sad, angry, tense, worried, irritated, confused, enthusiastic, pleased, cheerful, and happy; adjusted from Stel, Van Dijk, & Olivier, 2009).

Results and discussion

Indirect measure

Again, a confirmatory principal components analysis (See note 4) revealed a factor for negative emotions (frightened, fearful, anxious, nervous, penitential, regretful, guilty, repentant, sad, angry, tense, worried, irritated, and confused, α = .96) and a factor for positive emotions

Table 3. Means and standard deviations of participants' ratings of the targets' emotions by deception condition, expressed emotion and judged emotion of Study 2 (the higher the scores, the more attributed emotion, 1 = totally not experienced, 7 = very much experienced).

		Deception condition			
		Lie		Truth	
Expressed emotion	Judged emotion	M	SD	M	SD
Positive	Positive	5.26_a	0.79	4.46_b	0.95
	Negative	2.12_c	0.83	2.72_d	0.87
Negative	Positive	2.64_a	0.88	2.64_a	0.95
	Negative	3.29_b	0.91	3.54_c	0.93

Note: Means with noncommon subscripts differ significantly ($p < .05$) within each expressed emotion condition.

(enthusiastic, pleased, cheerful, and happy, $\alpha = .92$). Means for each factor were calculated and used for further analyses.

A 2 (deception condition: lie vs. truth) × 2 (expressed emotion: positive vs. negative) × 2 (judged emotion: positive vs. negative) within-subjects ANOVA was conducted (see Table 3 for means and contrast tests). A main effect of expressed emotion, $F(1, 79) = 75.48$, $p < .001$, $\eta_p^2 = .49$, Hedges's $g_{av} = 1.05$, indicated that participants rated targets expressing positive emotions as experiencing more intense emotions ($M = 3.64$, SD = 0.51) than targets expressing negative emotions ($M = 3.03$, SD = 0.63). A main effect of judged emotion, $F(1, 79) = 196.93$, $p < .001$, $\eta_p^2 = .71$, Hedges's $g_{av} = 1.19$, indicated that participants inferred more positive ($M = 3.75$, SD = 0.62) than negative ($M = 2.92$, SD = 0.75) emotions for the targets.

Furthermore, we observed three significant 2-way interactions: a deception condition x expressed emotion interaction, $F(1, 79) = 7.60$, $p = .01$, $\eta_p^2 = .09$, a deception condition x judged emotion interaction, $F(1, 79) = 74.47$, $p < .001$, $\eta_p^2 = .49$, and an expressed emotion x judged emotion interaction, $F(1, 79) = 376.98$, $p < .001$, $\eta_p^2 = .83$. These interaction effects were qualified by a 3-way interaction between deception condition, expressed emotion, and judged emotion, $F(1, 79) = 28.79$, $p < .001$, $\eta_p^2 = .27$. To interpret this 3-way interaction, we conducted paired-samples t-tests for positive and negative expressed emotions.

Positive expressed emotions. When positive emotions were expressed, more positive emotions were inferred for targets lying that they felt positive ($M = 5.26$, SD = 0.79) than for targets telling the truth about feeling positive ($M = 4.46$, SD = 0.95), $t(79) = -7.64$, $p < .001$, Hedges's $g_{av} = -0.91$. Furthermore, more negative emotions were inferred for targets telling the truth about feeling positive ($M = 2.72$, SD = 0.87) than for targets lying about feeling positive ($M = 2.12$, SD = 0.83), $t(79) = 8.56$, $p < .001$, Hedges's $g_{av} = -0.70$. Thus, as in Study 1, participants were unable to accurately distinguish true positive emotions from deceptive positive emotions.

Negative expressed emotions. When negative emotions were expressed, more negative emotions were inferred for targets telling the truth about feeling negative ($M = 3.54$, SD = 0.93) than for those lying that they felt negative ($M = 3.29$, SD = 0.91), $t(79) = 3.40$, $p = .001$, Hedges's $g_{av} = 0.27$. Participants did not differ in their inferences of positive emotions for targets telling the truth about feeling negative ($M = 2.64$, SD = 0.95) and targets lying that they felt negative ($M = 2.64$, SD = 0.88), $t(79) < 1$, $p = .98$, Hedges's $g_{av} = 0.00$. Thus, as in Study 1, participants did not distinguish liars from truth tellers who displayed negative

Table 4. Means and standard deviations of participants' ratings of the targets' deception judgment by deception condition and expressed emotion of Study 2 (the higher the scores, the more deceitful, 1 = totally not deceitful, 7 = very much deceitful).

	Deception condition			
Expressed emotion	Lie		Truth	
	M	SD	M	SD
Positive	3.17_{a}	0.93	3.41_{a}	0.96
Negative	3.71_{b}	0.86	4.32_{c}	0.90

Note: Means with noncommon subscripts differ significantly ($p < .05$) within each column and row. Furthermore, the positive-lie and positive-truth conditions differed marginally significantly ($p = .09$).

emotional expressions when inferring the targets' positive emotions. They were able to distinguish liars from truth tellers who displayed negative emotional expressions when inferring the targets' negative emotions.

Direct measure

The two questions asking to what extent the targets was telling the truth and lying were highly correlated (–.86). Therefore, both questions were averaged after recoding the truth question ($\alpha = .92$).

A 2 (deception condition: lie vs. truth) × 2 (expressed emotion: positive vs. negative) ANOVA was conducted with this average judgment as a dependent variable (see Table 4 for means and contrast tests). A main effect of deception condition, $F(1, 79) = 19.17$, $p < .001$, $\eta_p^2 = .20$, Hedges's $g_{av} = -0.64$, indicated that truth tellers were evaluated as more deceitful ($M = 3.87$, SD = 0.65) than liars ($M = 3.44$, SD = 0.69). A main effect of expressed emotion, $F(1, 79) = 48.11$, $p < .001$, $\eta_p^2 = .38$, Hedges's $g_{av} = 1.04$, indicated that targets expressing negative emotions were evaluated as more deceitful ($M = 4.01$, SD = 0.67) than targets expressing positive emotions ($M = 3.29$, SD = 0.70). Finally, a marginally significant interaction between deception condition and expressed emotion, $F(1, 79) = 3.89$, $p = .052$, $\eta_p^2 = .05$, showed that truth tellers were more strongly evaluated as deceitful compared with liars when they expressed negative emotions (respectively, $M = 4.32$, SD = 0.90 vs. $M = 3.71$, SD = 0.86), $t(79) = 4.80$, $p < .001$, Hedges's $g_{av} = -0.69$, than when they expressed positive emotions (respectively, $M = 3.41$, SD = 0.96 vs. $M = 3.17$, SD = 0.93), $t(79) = 1.71$, $p = .09$, Hedges's $g_{av} = -0.25$. In sum, as in Study 1, participants could not accurately distinguish between truth tellers and liars on a direct measure, regardless which emotion was expressed.

General discussion

Our participants were more accurate in detecting deception when negative than when positive emotions were expressed. This effect was found when observers judged deception indirectly, by inferring emotions felt by liars and truth tellers. This effect was not found when observers judged deception directly, by asking to what extent they thought the target was telling the truth or lying.

Our findings replicate the findings of previous studies investigating detecting deception in showing that it is hard to detect from *positive* nonverbal expressions whether the expressed emotion is true or false (e.g., Ekman & O'Sullivan, 1991). Our results also corroborate the results on *negative* expressions of Porter and ten Brinke (2008): In their study,

observers could also not distinguish between true and deceptive negative emotional expressions on a direct measure. Importantly, we extend previous studies by showing that when measuring detection deception indirectly with an emotion measure, observers are more accurate in judging true and deceptive negative expressions than true and deceptive positive expressions.

Our studies do not give insight into what exactly caused the observers to be able to distinguish on an indirect emotion measure between liars and truth tellers who expressed negative emotions, while not being able to do so when liars and truth tellers expressed positive emotions. As observers are more efficient in detecting negative emotions in general (e.g., Fox et al., 2000), it is possible that *observers* are better assessors when estimating persons' true emotions from negative than from positive emotional expressions. We explain our results, however, differently. Porter and ten Brinke (2008) showed that *deceivers* show more inconsistencies in displaying deceptive negative emotions than deceptive positive emotions. Although observers are not able to pick up on these inconsistencies when asked to directly judge deception (Porter & ten Brinke, 2008), we argued and showed that observers do pick up on this when asked to judge deception indirectly using an emotion measure.[5] We do not argue that this is due to unconscious processes (see also Moi & Shanks, 2015), but to a shift in focus to deception cues that are present. Asking observers to estimate targets' emotions made them focus more on emotions, which increased people's detecting deception accuracy as emotional deception cues are present. This explanation is in line with Street and Richardson's findings (2016) that observers focus more on diagnostic deception cues when using an indirect measure, whereas observers integrate a set of diagnostic and non-diagnostic cues when using a direct measure, which reduces deception detection accuracy.

Alternatively, the indirect emotion measure could have focused observers more on visual and affective details that may differ between liars and truth tellers. Although all liars and truth tellers watched a video, liars were asked to lie about this and received written information about another video they could use for their lie. Thus, as in real life, liars and truth tellers differed in the richness of the source they used for their story, which could cause differences in the frequency of visual, auditory, spatial, temporal, cognitive and affective details in their statements (e.g., Logue, Book, Frosina, Huizinga, & Amos, 2015). Although the videos in our studies were presented without sound to eliminate such alternative verbal explanations, it is still possible that the richness in verbal details may have caused non-verbal changes as well (e.g., Logue et al., 2015). An indirect emotion measure could have shifted observers' attention to these deception cues, leading to increased detecting deception accuracy. This alternative explanation, however, cannot explain why the indirect emotion measure increased accuracy only for negative emotions. After all, the richness would also differ for liars and truth tellers expressing positive emotions.

Another alternative explanation is mood. Mood can be elicited when watching positive or negative facial expressions (Lundqvist, 1995) and has been shown to influence information processing. People in a positive mood rely more on heuristics, while people in a negative mood engage in effortful and cautious processing (Bless, Bohner, Schwarz, & Strack, 1990; Bodenhausen, Kramer, & Süsser, 1994). One might reason that this cautiousness could also (partly) explain why people are more accurate when inferring emotions for a person displaying negative expression. Although we can envisage such a process, it should be noted that Ambady and Gray (2002) demonstrated that a negative mood does not increase accuracy for social judgments of *nonverbal* behaviors. The possibility of negative mood effects on

detection deception accuracy might have been higher if we would have allowed for verbal communication (Reinhard & Schwarz, 2012).

At this point it is also appropriate to discuss the effect sizes we observed. In particular, note that the effect sizes of the direct measures were lower than the effect sizes of the direct measures that have been reported in previous meta-analyses. The meta-analyses of Bond and DePaulo (2006) and Bond et al. (2015) obtained small to medium positive effect sizes. In our studies, for both positive and negative expressed emotions, we obtained small to large negative effect sizes, indicating that observers inaccurately distinguished between liars and truth tellers. This might suggest that the direct measure decreases detection deception instead of the indirect emotion measure increasing deception (Levine & Bond, 2014).

It should be noted, however, that the effect size of the indirect emotion measure for positive emotional expressions, however, is also large and negative as our direct measure, while the indirect measures in the meta-analysis of Bond et al. (2015) obtained zero to medium positive effect sizes. So the effect sizes of our studies for both direct and indirect measures are not comparable to the effect sizes of the meta-analyses. This suggests that it may have been harder to detect deception from the materials we used in our studies compared with other studies. A first reason for this could be that in our studies observers received visual information only, while the majority of studies in meta-analyses included audio and visual information (Bond & DePaulo, 2006). Secondly, in our studies, the content of the lies and truths concerned emotions. It is possible that those type of lies and truths are harder to detect than others. If more unreliable and contradicting cues are present when expressing true and deceptive emotions, detecting deception accuracy is decreased (Street & Richardson, 2015). Also, a direct measure using a multipoint rating scales decreases lie-truth discrimination ability (Bond & DePaulo, 2006).

To conclude, when asked directly, lies on experienced emotions remained undiscovered regardless which emotions are expressed. However, our findings show that people are better able to distinguish liars from truth tellers when inferring emotions of negative expressive nonverbal behaviors than of positive expressions. The ability to distinguish true from deceptive emotions thus depends on both the valence of emotions (positive versus negative) and assessment procedure (direct vs. indirect emotion measure).

Notes

1. The direct question was not measured on a binary scale because we felt that honesty judgments such as these are not binary in nature, i.e., people may be less or more convinced about someone telling the truth. Using a 7-point scale allowed a more sensitive measurement than a yes/no judgment. Studies that also used a multipoint rating scale showed decreased lie-truth discrimination ability compared to studies that used a binary measure (Bond & DePaulo, 2006). Also, the use of a 7-point scale allowed for a better comparison with our indirect emotion measure (Van 't Veer, 2015).
2. When comparing positive and negative emotions for each target separately, we observed that this difference between emotions depending on video was present for each person (i.e., each target who watched the positive film fragment reported to experience more positive than negative emotions and each target who watched the negative film fragment reported to experience more negative than positive emotions).
3. After the interaction, liars and truth tellers were asked to what extent they thought they were successful in convincing the other student for having told the truth. There were no differences in self-rated ability to convince between liars and truth tellers, neither between persons who expressed positive or negative emotions, or a combination of these factors, Fs < 1.

4. Exploratory principal components analyses on the emotion items in Studies 1 and 2 yielded three distinct factors based on Eigenvalues greater than 1. The first factor consisted of all the negative emotion items, except for the item tense in Study 1. The second factor consisted of all the positive emotion items, except for the item pleased in Study 2. The third factor in Study 1 consisted of the emotion item tense and in Study 2 pleased. Therefore (confirmatory) principal components analyses in both studies were done with two fixed factors.
5. EMFACS coding the twelve video fragments we used did not provide conclusive evidence as more videos are needed to be able to show differences, if any, in emotional inconsistency between senders.

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