

## BRIEF REPORT

# Emotion expression among abusive mothers is associated with their children's emotion processing and problem behaviours

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The current study evaluated the quality of facial and vocal emotional expressions in abusive and non-abusive mothers, and assessed whether mothers' emotional expression quality was related to their children's cognitive processing of emotion and behavioural problems. Relative to non-abusive mothers, abusive mothers produced less prototypical angry facial expressions, and less prototypical angry, happy, and sad vocal expressions. The intensity of mothers' facial and vocal expressions of anger was related to their children's externalising and internalising symptoms. Additionally, children's cognitive processing of their mothers' angry faces was related to the quality of mothers' facial expressions. Results are discussed with respect to the impact of early emotional learning environments on children's socioemotional development and risk for psychopathology.

**Keywords:** Facial expressions; Vocal expressions; Physical abuse; Psychopathology; Mothers.

Facial and vocal expressions of emotion convey important social information, and a child's ability to accurately recognise these expressions in others is a critical aspect of adaptive social development. In the context of child–caregiver interactions, young children learn how to extract meaning

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from emotional expressions, and over time they learn how to use that knowledge to successfully guide their interactions with others (Eisenberg, Cumberland, & Spinrad, 1998). In fact, parental emotional expressivity during childhood has been shown to predict children's prosocial behaviour into adolescence (Michalik et al., 2007). However, atypical emotional environments can result in emotion-processing deficiencies that may place children at risk for later development of socio-emotional and behavioural difficulties (Pollak, 2005). Previously, we reported that physically abused children showed enhanced selective attention toward their own abusive mother's angry face relative to non-abused children's processing of their own mother's face, as indexed by the P3b component of the event-related potential (ERP; Shackman, Shackman, & Pollak, 2007). In the present paper, we examine differences in the way that abusive mothers express emotions, and relate these differences in emotional expression to children's cognitive processing of emotions and to risk for poor mental-health outcomes.

Parental socialisation and expressivity (including support in response to child distress, and parental displays of emotion) plays an important role in the development of psychological risk and resilience in children (Cumberland-Li, Eisenberg, Champion, Gershoff, & Fabes, 2003). For example, lack of maternal support in response to children's emotions was found to contribute to poor emotion-regulation skills in physically abused children (Shipman et al., 2007). Moreover, deficits in parents' ability to produce appropriate and recognisable emotional expressions may make it difficult for children to develop adaptive socio-emotional skills. However, only a small number of studies have examined the relationship between children's expressive environments and their ability to recognise and express emotions in various atypical care-giving contexts. Mothers of socially anxious children produced less intense facial emotional expressions than mothers of non-anxious children (Melfsen, Osterlow, & Florin, 2000) and depressed mothers' emotion-production abilities were related to their children's

emotion-expression skills (Arsenio, Sesin, & Siegel, 2004).

Parents who physically abuse their children have been characterised by increased hostility, intrusive behaviour, aggressive outbursts, and negative parenting techniques (Bousha & Twentyman, 1984; Lyons-Ruth & Block, 1996). These mothers have also been found to produce less recognisable facial expressions relative to non-abusive mothers (Camras et al., 1988), and their children were less accurate than non-abused peers in their emotion-recognition ability (Camras et al., 1990). As a potential consequence of being raised in an abusive environment, physically abused children show social and emotional processing difficulties. When interacting with distressed peers, abused toddlers were more likely to respond with fear or anger, rather than exhibiting concern or empathy (Main & George, 1985), and abused children were shown to have a poorer understanding of the causes of emotions compared to non-abused children (Perlman, Kalish, & Pollak, 2008). Consistent with these findings, several studies have demonstrated biases in the processing of threatening social information in physically abused children (Dodge, Pettit, Bates, & Valente, 1995; Pine et al., 2005), and recently we showed that a larger P3b ERP in response to abused children's own mothers' angry faces predicted greater internalising symptoms (Shackman et al., 2007).

Despite the recognised importance of maternal expressivity, little research has explored how characteristics of mothers' emotion expressions may contribute to development of socioemotional problems in their children. Moreover, although vocal expressions of emotion are encountered just as often as facial expressions in daily life, most research on maternal expressivity has focused on facial expressions, with the study of vocal expression and recognition receiving much less attention (Bachorowski & Owren, 2008). Thus, the current study aimed to investigate the relationship between mothers' facial and vocal emotional expressivity and children's emotion processing and risk for psychopathology, among physically abusive and non-abusive mother-child dyads.

The current study had two major aims. Our first aim was to evaluate abusive and non-abusive mothers' facial and vocal expressions of emotion to determine whether they differed on key expressive characteristics. We used two methods of evaluation: Naïve adult raters first assessed expressions based on their prototypicality. Facial expressions were then evaluated using Ekman, Friesen, and Hager's (2002) Facial Action Coding System (FACS), and vocal expressions were evaluated using an acoustic analysis of fundamental frequency ( $F_0$ ).  $F_0$  corresponds to the rate of vocal-fold vibration during the production of phonated speech and is highly correlated with the perception of vocal pitch. In general, emotions expressed with a higher level of arousal (e.g., anger, excitement) are associated with increased mean  $F_0$  and  $F_0$  variability (Bachorowski & Owren, 2008). We hypothesised that abusive mothers would produce less prototypical facial and vocal expressions of anger compared to non-abusive mothers, consistent with prior research (Camras et al., 1988).

Our second aim was to investigate whether characteristics of mothers' emotion expressions were related to their children's symptoms of psychopathology and attentional processing of emotions (as reported in Shackman et al., 2007). We predicted that reduced intensity of expression and/or reduced prototypicality would be related to greater symptoms of child psychopathology and children's increased attention allocation toward their mothers' emotion expressions.

## METHOD

### Participants

Participants in this study were 19 abusive and 23 non-abusive mothers (age range = 25–50 years,  $M = 37.4$ ,  $SD = 7.4$ ) and their 29 abused and 28 non-abused children (age range = 7 to 12 years,  $M = 9.6$ ,  $SD = 1.8$ ). All mothers and children had participated in our previous study, during which children's emotion processing was measured (Shackman et al., 2007). However, our previous study did not assess mothers' emotional

expressions or their relationship to children's behaviour and emotion processing. Abused and non-abused children did not differ on age,  $p > .3$ . Abusive mothers and their children were recruited by letters forwarded by the Dane County (WI) Department of Human Services to families with substantiated cases of physical abuse. Non-abusive mothers and their children were recruited by posting fliers in the same neighbourhoods from which physically abusive families were drawn. Parents completed the Parent–Child Conflict Tactics Scale (PCCTS; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998), a 20-item measure of the frequency with which a parent has carried out specific acts of physical aggression toward the child. To qualify as a non-abusive mother for the current study, scores below 10 were required on the PCCTS. Mothers who scored at least 20 on the PCCTS and/or had substantiated cases of child physical abuse on record with the Dane County Department of Human Services were classified as abusive. Families were unaware of their classification into abuse groups.

### Maternal emotion expression

For the emotion-expression task, mothers were asked to produce facial and vocal expressions for anger, happiness, and sadness. To facilitate this process and encourage spontaneity of expression, mothers were asked to recall a memory or imagine a situation that would help them to accurately express the desired emotion on their face and through their voice, and were given the opportunity to practice their emotional expressions using a mirror. Facial images were captured using a Sony Mavica digital camera (MVC-CD400). For the vocal recordings, mothers were asked to read five semantically neutral two-word sentences using happy, sad, and angry vocal tones. Vocal stimuli were recorded with a Sony MiniDisc recorder (MZ-N1) and edited using Cool-Edit software to equalise the volume and length of each utterance (approximately 700 ms). Mothers reviewed the photographs and vocal recordings and, along with the experimenter, selected the exemplars they felt best depicted their targeted

emotional state. A total of 3 facial expressions (1 per emotion) and 15 vocal samples (5 per emotion) were obtained for each mother. Digital photographs were edited with Adobe Photoshop so that each facial stimulus was similar in size, contrast, and luminance.

We measured each child's self-report of depressive symptomatology with the Child Depression Inventory (CDI; Kovacs, 1992). Reliability of the CDI ranges from .71 to .89. Child self-reported anxiety was assessed using the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978). Reliability for the RCMAS ranges from .60 to .88. Additionally, the Child Behaviour Checklist (CBCL; Achenbach & Edelbrock, 1981) was completed by parents to assess their child's levels of internalising and externalising symptoms. Reliability for the CBCL ranges from .86 to .94.

### Scoring

To examine potential differences in mothers' emotion expressive abilities, 140 undergraduate students (88 females) rated each of the facial and vocal expressions produced by the mothers. Undergraduate raters were asked to rate each expression, based on its prototypicality, or the extent to which they thought each expression reflected a typical example of that emotion, on a 10-point scale. Before evaluating the facial expressions, raters were presented briefly with all of the stimulus items. Raters viewed two presentations of each face (6 faces per mother), grouped by emotion. Raters then heard each of the five vocal samples (15 samples per mother), grouped by emotion. Order of emotion expressions was randomised within emotion block, and emotion blocks were counterbalanced between raters. Mean ratings were computed for each emotion category and stimulus modality for each mother (6 ratings per mother).

The facial expressions were then scored by coders certified to use Ekman et al.'s (2002) Facial Action Coding System (FACS). FACS is an anatomically based system in which the coding units are discrete actions of the facial muscles

(termed action units or AUs), rather than the presence or absence of particular emotional expressions. Using the FACS Investigator's Guide, we identified those AUs involved in the prototypic expressions for happiness, anger, and sadness. The prototype-associated movements were AUs 6 (cheek raiser) and 12 (lip corner puller) for happiness, AUs 1 (inner brow raiser), 4 (brow lowerer), 15 (lip corner depressor), and 17 (chin raiser) for sadness, and AUs 4 (brow lowerer), 5 (upper lid raiser), 7 (eyelid tightener), 23 (lip tightener) and 24 (lip pressor) for anger. For each expression, the coder determined whether each AU involved in the prototype was present and, if so, assigned it an intensity score (range = 1 to 5). Because photographs of neutral expressions were not utilised in the study, scoring was based only on cues provided in the expression photos rather than comparisons to the mothers' neutral facial expressions.

To calculate reliability, a second trained FACS coder scored 10 expressions of each emotion for presence versus absence of each of the AUs associated with the prototypic face for the given emotion. Mean kappas across the target AUs for each emotion were .74 for happiness, .87 for sadness and .92 for anger. Kappas for each individual AU exceeded 0.7 with the exception of AU6 which equalled 0.6. Since reliability in intensity coding is not evaluated during the FACS training and certification process, intensity codes for the present study were reviewed by both raters and the final scoring established through consensus. Coders were unaware of each family's abuse status.

Speech samples were analysed using ESPS/WAVES+ 5.2 digital signal-processing software (Entropic Research Lab, Washington, DC). Files were first downsampled to 11.025 kHz and normalised to a common maximum-amplitude value. Each file was then segmented with cursor-based onset and offset marks. Acoustic measures focused on duration and several measures derived from the fundamental frequency ( $F_0$ ): mean  $F_0$ ,  $SD F_0$ , minimum  $F_0$ , and maximum  $F_0$ . Durations were extracted from onset and offset markers.  $F_0$ -related analyses were conducted using

ESPS/WAVES + native pitch-tracking algorithm to extract an  $F_0$  contour for each speech sample, and then overlaying that contour on a corresponding narrowband spectrogram for visual inspection. Cursors were then used to isolate the longest period of each file for which the algorithm accurately tracked  $F_0$ . Summary statistics for these segments were derived through unix-csh-script routines.

### Measurement of cognitive processing

Children's cognitive processing of their mother's facial and vocal expressions was measured by recording ERPs while children performed a modified oddball emotion recognition task. Briefly, children were given a "target" emotion (anger, happiness, or sadness) and were instructed to press a button when they either saw or heard (depending on the experimental condition) the target emotion. For details on this task, data recording, and scoring, see Shackman et al. (2007). For the purposes of the current study, we were interested in the P3b component of the ERP, which is typically used as an index of attention allocation, and its amplitude varies as a function of task-relevance, emotional salience, and stimulus quality (e.g., Fabiani, Gratton, & Coles, 2000).

## RESULTS

We first determined whether abusive mothers produced facial and vocal emotion expressions that differed from those produced by non-abusive mothers, by using a more general rating system followed by a more fine-grained evaluation of each expression. We then examined how mothers' expressive features were related to their child's behaviour problems and emotion-processing measures.

### Undergraduate ratings of mothers' faces and voices

A repeated-measures analysis of variance (ANOVA) was conducted separately for each modality on the scores provided by 140 undergraduate raters for each stimulus item, with Status of

Mother (abusive, non-abusive) and Emotion (angry, happy, sad) as within-participants factors. For facial expressions, there was a main effect of Emotion,  $F(2, 278) = 113.8, p = .00$ , as well as an interaction between Mother Status and Emotion,  $F(2, 278) = 3.36, p = .04$ . For vocal expressions, there were main effects of Emotion,  $F(2, 278) = 24.8, p = .00$ , and Mother Status,  $F(1, 139) = 441.2, p = .00$ , as well as an interaction between Mother Status and Emotion,  $F(2, 278) = 66.1, p = .00$ . The interactions were followed by conducting conventional paired-samples  $t$ -tests to examine perceived group differences in expressive ability for facial and vocal expressions of each emotion. Abusive mothers produced facial expressions of anger that raters perceived as less prototypical than those produced by non-abusive mothers,  $t(139) = 2.29, p = .02$ . Yet, the two groups of mothers produced equivalent expressions of happiness and sadness,  $p_s > .3$ . All of the vocal expressions produced by abusive mothers were evaluated as less prototypical than those produced by non-abusive mothers: anger,  $t(139) = 10.56, p = .001$ , happiness,  $t(139) = 22.52, p = .001$ , sadness,  $t(139) = 8.42, p = .001$ . Using Tukey's HSD test to control the error rate for each family of contrasts yielded equivalent conclusions ( $p_{\text{critical}} = .02$ ).

### Facial-action coding

Our next step was to conduct a more in-depth analysis of specific features of the abusive mothers' emotion expressions. Results of the facial-action coding are presented in Table 1. Separate repeated-measures ANOVAs were performed for each of the three Emotions (happiness, anger, and sadness) with Abuse Group (abusive vs. non-abusive mothers) as a between-subject factor and AU scores as the dependent measure. These analyses revealed that abusive mothers' anger expressions involved less intense lowered and contracted brows (AU4) than did the anger expressions of non-abusive mothers,  $F(1, 40) = 4.16, p = .05$ . Abusive mothers also had a tendency to smile less (AU12) than non-abusive mothers,  $F(1, 40) = 3.53, p = .07$ . Scores for AU4 were

**Table 1.** Mean  $\pm$  standard error of ratings for FACS-coded facial expressions. Expressions were coded on a 1- to 5-point scale

Emotion-relevant action units	Non-abusive mothers	Abusive mothers
<i>Anger</i>		
AU4 (brow lowered)*	1.79 $\pm$ 0.22	2.70 $\pm$ 0.23
AU5 (upper eyelid raised)	0.32 $\pm$ 0.15	0.30 $\pm$ 0.16
AU7 (eyelids tightened)	1.84 $\pm$ 0.21	2.13 $\pm$ 0.23
AU23 (lips tightened)	0.95 $\pm$ 0.20	0.87 $\pm$ 0.21
AU24 (lips pressed)	0.42 $\pm$ 0.16	0.57 $\pm$ 0.15
<i>Happiness</i>		
AU6 (cheeks raised)	1.16 $\pm$ 0.17	1.30 $\pm$ 0.17
AU12 (lip corners pulled)**	2.84 $\pm$ 0.11	3.35 $\pm$ 0.16
<i>Sadness</i>		
AU1 (inner brow raised)	0.21 $\pm$ 0.07	0.32 $\pm$ 0.13
AU15 (lip corners lowered)	0.21 $\pm$ 0.11	0.22 $\pm$ 0.08
AU17 (chin raised)	0.40 $\pm$ 0.16	0.25 $\pm$ 0.11

Notes: \*Group difference significant at  $p < .05$ . \*\*Trend towards group differences at  $p = .07$ .

positively related to undergraduate ratings of the typicality of mothers' angry facial expressions,  $r(40) = .36$ ,  $p = .04$ .

### Acoustic analyses

Acoustic variables were analysed with Abuse Group (abusive vs. non-abusive mothers) as a between-participants factor and Emotion (happiness, anger, sadness) as a within-participants factor. Dependent measures included duration,  $F_0$  mean,  $F_0$  minimum,  $F_0$  maximum and  $F_0$  standard deviation (acoustic variability; see Table 2). The overall ANOVA revealed main effects of Emotion for every acoustic measure examined—duration:  $F(2, 320) = 11.63$ ,  $p < .001$ ; mean  $F_0$ :  $F(2, 320) = 153.75$ ,  $p < .001$ ;  $SD F_0$ :  $F(2, 320) = 54.18$ ,  $p < .001$ ; minimum  $F_0$ :  $F(2, 320) = 65.97$ ,  $p < .001$ ; maximum  $F_0$ :  $F(2, 320) = 151.08$ ,  $p < .001$ . Among all mothers, duration was longest for sadness, followed by happiness and anger. For the  $F_0$ -related acoustics, means were highest for happiness, lower for anger, and yet even lower for sadness. Across emotions, abusive mothers produced vocal samples with lower and less variable  $F_0$ , arguably reflecting vocal emotion portrayals characterised by less intensity and arousal—mean  $F_0$ :  $F(1, 39) = 11.08$ ,  $p < .01$ ;  $SD F_0$ :  $F(1, 39) = 8.67$ ,  $p < .01$ ; minimum  $F_0$ :  $F(1,$

39) = 4.38,  $p < .05$ ; maximum  $F_0$ :  $F(1, 39) = 14.07$ ,  $p < .001$ . Undergraduate ratings of the typicality of mothers' angry vocal expressions were positively related to both their mean  $F_0$ ,  $r(40) = .44$ ,  $p < .01$ , and its variability,  $r(40) = .47$ ,  $p < .01$ . Positive relationships were also obtained between undergraduate ratings of mothers' happy vocal expressions and acoustic measures—mean  $F_0$ ,  $r(40) = .49$ ,  $p < .01$ , and variability,  $r(40) = .36$ ,  $p < .05$ —and between undergraduate ratings of mothers' sad vocal expressions and acoustic measures—mean  $F_0$ ,  $r(40) = .45$ ,  $p < .01$ , and variability,  $r(40) = .37$ ,  $p < .05$ . Thus, taken together, our results suggest that abusive mothers were less able than non-abusive mothers to generate highly typical vocal expressions of emotion.

### Relationship between maternal expressive behaviour and children's behaviour problems and psychopathology

Next, we sought to determine whether mothers' expressive behaviour was related to their children's psychopathology symptoms and problem behaviours. Mothers with poorly conveyed facial anger expressions (reduced AU4 activation) had children who exhibited more anxiety,  $r(55) = -.33$ ,  $p = .03$ , depression,  $r(55) = -.47$ ,  $p = .001$ , and aggressive behaviour,  $r(55) = -.36$ ,  $p = .003$ .

**Table 2.** Mean  $\pm$  standard error of acoustic analyses

<i>Acoustic parameter</i>	<i>Abusive mothers</i>	<i>Non-abusive mothers</i>
<i>Duration</i>		
Anger	0.59 $\pm$ 0.01	0.60 $\pm$ 0.01
Happiness	0.61 $\pm$ 0.01	0.62 $\pm$ 0.01
Sadness	0.62 $\pm$ 0.01	0.64 $\pm$ 0.01
<i>Mean F<sub>0</sub></i>		
Anger*	207 $\pm$ 7	231 $\pm$ 6
Happiness*	267 $\pm$ 6	293 $\pm$ 8
Sadness*	173 $\pm$ 5	290 $\pm$ 6
<i>Standard Deviation F<sub>0</sub></i>		
Anger*	33.1 $\pm$ 2.3	43.5 $\pm$ 2.6
Happiness*	44.4 $\pm$ 3.5	53.4 $\pm$ 2.8
Sadness	24.4 $\pm$ 1.6	25.2 $\pm$ 1.6
<i>Min F<sub>0</sub></i>		
Anger	144 $\pm$ 6	153 $\pm$ 5
Happiness	196 $\pm$ 7	109 $\pm$ 8
Sadness*	134 $\pm$ 5	155 $\pm$ 6
<i>Max F<sub>0</sub></i>		
Anger*	257 $\pm$ 11	299 $\pm$ 9
Happiness*	344 $\pm$ 10	384 $\pm$ 11
Sadness*	216 $\pm$ 7	239 $\pm$ 6

Notes: Duration is in seconds and  $F_0$  measures are in Hertz. \*Group difference significant at  $p < .05$ .

Similarly, reduced mean  $F_0$  of mothers' vocal expression of anger was associated with both greater internalising,  $r(55) = -.30, p = .03$ , and externalising child behaviour problems,  $r(55) = -.27, p = .05$ .

### Relationship between maternal expressions and children's cognitive processing

Finally, using the ERPs as reported in Shackman et al. (2007), we examined the relationship between children's cognitive processing of their mothers' facial and vocal emotion expressions and the characteristics of those expressions. When attending to their mothers' faces, children's P3b responses were inversely correlated with the intensity of their mother's brow lowering as measured by AU4,  $r(28) = -.51, p = .01$ . No other relationships emerged between children's ERPs and their mothers' expression of facial or vocal emotions.

### DISCUSSION

The current study revealed several differences in the ability of abusive mothers to express emotions. Abusive mothers produced less prototypical facial expressions of anger compared to non-abusive mothers. This finding was specific as we did not find differences for facial expressions of happiness or sadness. Moreover, abusive mothers' facial expressions involved less intense brow lowering and contracting, a facial movement integral to the expression of anger. This finding is consistent with the previously recognised importance of the eye and brow area for accurate perception of anger expressions, and its relation to ratings of anger expression intensity (Matsumoto, 1989).

Abusive mothers also produced vocal expressions of anger, happiness, and sadness that were perceived as less prototypical. More detailed acoustic analyses were consistent with this finding, such that abusive mothers showed less emotion in their vocal portrayals across all three emotions.

Specifically, the acoustic characteristics of abusive mothers' speech were not as variable as the samples produced by non-abusive mothers. Overall, acoustic outcomes for the three emotions we examined were consistent with those reported elsewhere (Johnstone & Scherer, 2000), with  $F_0$ -related measures being highest for happiness, intermediate for anger, and lowest for sadness. More intense emotional expression has been shown to correspond to higher rates of recognition (Dawson, Frey, Panagiotides, Osterling, & Hessl, 1997), suggesting that abusive mothers' vocal expressions may be more difficult to interpret.

As predicted, relationships emerged between mothers' anger expression and children's psychopathology. Less intense facial expressions of anger among mothers were related to greater anxiety, depression, and externalising behaviours in children. Less intense vocal expression among mothers was related to more internalising and externalising psychopathology symptoms in children. These findings suggest the possibility that children raised in less emotionally expressive environments may have increased risk for emotional and behavioural problems. Moreover, they are consistent with prior research indicating that reduced family expressiveness is associated with poorer emotion understanding in children (Halberstadt & Eaton, 2002).

Abused children whose mothers showed less intense anger facial expressions actually devoted *more* cognitive resources toward processing those expressions in their mothers' faces (see also Shackman et al., 2007). This is consistent with research demonstrating that degraded stimuli (i.e., increased perceptual difficulty) produce an increase in P3b amplitude (Kok, 1997). These results suggest that physically abused children may need to work harder to learn about and recognise important emotional signals in their environment if these signals are expressed in a less clear and consistent manner. Our finding is also consistent with the idea that children raised in low-expressive families need to be more skilled at decoding fragmented or less intense emotion expressions, and they become more successful at this over time (Halberstadt & Eaton, 2002). More

effort devoted to processing unpredictable but salient threat signals may also mean that fewer resources are available for interpreting other social cues, which may lead children to misconstrue the expressions and intentions of others and promote difficulties in social interactions.

Several important caveats to this work must be noted. First, we did not obtain neutral (modal) speech acoustics in this study. Thus it is not entirely clear whether abusive mothers were less emotional in their portrayals or in fact typically have lower modal speech values for the acoustic measures we examined. Second, as noted previously, we were not able to record completely spontaneous emotional expressions in this study. However, mothers were encouraged to be spontaneous in their production of each emotion expression and this was facilitated by asking mothers to recall an event that had elicited the desired emotion in the past. Yet, we are cautious in making assumptions on the relationship between the expressions produced in the laboratory and expressions that occur during true naturalistic situations. However, emotion expressions produced in the laboratory may offer some advantages over truly naturalistic expressions as they provides a degree of experimental control that is needed in order to investigate differences in emotion recognition (Johnstone & Scherer, 2000). For example, attempts to provoke spontaneous emotion may not necessarily elicit the same target emotion in all mothers and photographs of truly naturalistic expressions would be incredibly difficult to obtain and use in an experimental context. In light of these challenges, examining the correspondence between mothers' emotion-expression ability in the laboratory and the nature of their "real-life" expressions in multiple contexts will be an important issue for future research. Third, we unfortunately cannot rule out the possibility of differences in mothers' degree of motivation to produce high-quality expressions. However, if abusive mothers were simply less motivated, we would have expected to find differences across all facial expressions, not just anger. Additionally, the quality of mothers' expressions was found to be meaningfully and



consistently related to multiple measures of children's psychological well-being and cognitive processing. Thus, we do believe that the information afforded by examining expressions in the laboratory provides an important window into mothers' emotional communication abilities and their children's expressive environments.

In sum, the current findings suggest that abusive mothers' expressions of anger may be characterised by less intensity and arousal, which in the eyes and ears of their children may correspond to expressions that are less predictable and more difficult to interpret. If these emotional expressions do indeed provide a glimpse into an individual's emotional behaviour, then our results suggest that abused children may be exposed to poorer quality emotional signals (i.e., less clear and more difficult to understand), such that they could be lacking a potentially significant source of information about the meaning of emotional expressions. Exposure to poorer quality emotion signals conveyed by a caregiver may put children at risk for both internalising and externalising symptoms, depending on the particular expressive style of the caregiver. The current study indicates that there is a need for more precise investigations into the mechanisms by which features of a child's emotional environment impacts emotional development and risk for psychopathology. Such inquiries may lead to the development of interventions targeted at increasing the quality of expressive interactions that occur between children and their parents, with the hope of reducing the risk of emotional and behaviour difficulties in abused children.

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