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Associations of Child Emotion Recognition with Interparental Conflict and Shy Child Temperament Traits

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Abstract

Severe early adversity, such as maltreatment and neglect, has been associated with alterations in children's recognition of emotion. We sought to build on such findings by testing whether children's exposure to interparental conflict, a much less severe form of adversity, is also associated with children's emotion recognition. Further, we sought to examine the role of temperamental shyness in these associations. We presented 99 nine- to eleven-year-olds (56 males) with photographs of actors posing as a couple portraying interpersonal anger, happiness, and neutrality, and children classified the emotions in the photos. Children reported on interparental conflict, and their mothers reported on children's shyness. Children's perceptions of threat regarding interparental conflict interacted with trial type (angry, happy, neutral) to predict accuracy; greater threat perceptions predicted less accuracy for neutral expressions, a relatively ambiguous stimulus type. Additionally, shyness interacted with children's threat perceptions. At low levels of shyness, low levels of threat perceptions predicted high accuracy, whereas high threat, high shyness, and their combination predicted poorer accuracy. Results suggest the significance of interparental conflict in altering children's emotion recognition, and of shyness in strengthening such adaptations. These findings suggest that even forms of adversity that are less severe than maltreatment and neglect have substantial implications for emotion processing, particularly for children with shy traits.

Key words: children, emotion recognition, interparental conflict, shyness, threat

Associations of Child Emotion Recognition with Interparental Conflict and Shy Child Temperament Traits

Interparental conflict predicts poorer child functioning, including internalizing and externalizing problems, and poorer academic and social functioning (Cummings & Davies, 2002), and several key mechanisms underlying these associations have been identified (Cummings & Davies, 2010). Specifically, when the interparental relationship is functioning well, children derive a sense of emotional security that contributes to positive developmental outcomes, whereas destructive interparental conflict erodes that security, leading to poorer functioning (Davies & Cummings, 2006). In addition, children's cognitions about interparental conflict also play an important role in child functioning (Grych, Harold, & Miles, 2003). Children's self-blame for their parents' conflicts predicts higher levels of internalizing and externalizing problems, and children's perceptions of threat regarding interparental conflict predict higher levels of internalizing problems (Fosco & Grych, 2008), and are linked with externalizing problems (Fosco & Feinberg, 2014). Thus, previous work has made substantial headway in identifying some mechanisms underlying interparental conflict-child functioning associations. However, very few studies have examined associations between interparental conflict and children's recognition of others' emotions. Previous work suggests this may be an important area for investigation. That is, studies have consistently found that severe adversity alters children's emotion recognition (e.g., Pollak, Cicchetti, Hornung, & Reed, 2000). However, it is not clear whether interparental conflict exposure, a form of adversity that is much less severe, is also sufficient to alter emotion recognition. Moreover, temperament-related shyness, as a filter through which children view others, may increase children's vulnerability to interparental

conflict. The current study examines whether interparental conflict alters children's emotion recognition, and whether shyness strengthens these alterations.

Family Emotional Environment and Child Emotional Development

Reflecting experiential canalization, family experiences strengthen some abilities and weaken others, including potentially altering emotion processing abilities (Gottlieb, 1991; Raver, Blair, & Garrett-Peters, 2014). The emotional climate of the family can pose challenges for children's management of emotions, particularly if a high level of negative emotion is directed at the child (Thompson & Meyer, 2007). Alternatively, positive emotion in the family environment can facilitate children's managing emotions. Further, more frequent, elaborated mother-child conversation about emotion facilitates the development of children's understanding of emotion (Thompson & Meyer, 2007). Moreover, Gottman and his colleagues have described what they refer to as parents' meta-emotion philosophies, distinguishing between emotion-dismissing and emotion-coaching parents. Emotion-dismissing parents downplay emotions, particularly negative ones, whereas emotion-coaching parents view emotions as important to understand, and they encourage their children to process their emotions (Gottman, 2001). Examining associations between parents' meta-emotion philosophies, children's experiences with interparental conflict, and children's functioning, Katz and Gottman (1997) found that children of emotion-coaching parents had better functioning than other children with similar interparental conflict experiences. In addition, Hooven, Gottman, and Katz (1995) found that emotion-coaching parents had more positive, less negative marital interactions, and their children had better functioning. In contrast, for children whose parents have high levels of conflict and marital distress, emotions may be overwhelming (Katz & Gottman, 1995). Importantly, temperament has also been found to alter associations between parents' meta-emotion philosophies and their socialization of children's

affect during parent-child interactions. For example, for children with high levels of effortful control, mothers who were more aware of their own emotions were less discouraging of their children's dysphoric emotions during a mother-child interaction (Yap, Allen, Leve, & Katz, 2008).

Thus, this work demonstrates the important influence of parents in general, and the interparental relationship in particular, on children's emotional development, as well as the potential for temperament to shape these developmental processes. Moreover, when children find negative emotions in their families to be overwhelming, they are less likely to be able to process others' emotions adequately, potentially leading to poorer recognition of emotion. However, very few studies have examined associations between children's emotion recognition or attention to emotion and the interparental relationship. In one of the few studies to do so, El-Sheikh (1994) found children whose parents had higher levels of conflict rated simulated interadult conflict as less angry and sad than other children. Recent studies have examined associations between interparental aggression and children's emotion processing. Briggs-Gowan et al. (2015) found high levels of intimate partner violence were associated with children's attention bias toward happy faces on the dot-probe task. Further, Raver et al. (2014) found greater interparental physical aggression predicted children's worse overall recognition accuracy across emotions, using images of children posing emotional expressions. However, when poverty and household chaos were added as predictors, interparental verbal aggression emerged as a predictor of better emotion recognition. Thus, recent work has broken new ground in examining associations of the interparental relationship with children's emotion processing, but findings have been somewhat mixed. Because very few studies have examined associations between the interparental

relationship and children's emotion recognition, we draw on the literature on more severe forms of adversity to provide further basis for the current study.

Family-related Adversity and Emotion Processing

Theoretical perspectives emphasize the influence of severe adversity, such as neglect, poverty, and family violence, on children's emotional development (Blair & Raver, 2012; Susman, 2006). Several studies suggest severe adversity is associated with poorer emotion recognition and knowledge. When presented with stories describing an emotional situation and asked to select the protagonist's emotion from pictures of children exhibiting facial expressions of emotion, maltreated children have been found to be less accurate in selecting emotions than non-maltreated children (Camras et al., 1988; Pollak et al., 2000). Further, neglected children have been found to have poorer emotion knowledge (e.g., labelling, recognizing) than other children (Sullivan, Carmody, & Lewis, 2010). Regarding differences in children's recognition of different emotions, one pattern of findings involves children's processing of anger. Pollak et al. (2000) found that abused children showed a bias to identify expressions as angry, and compared with non-abused children, abused children accurately identified angry expressions based on less perceptual information (Pollak & Sinha, 2002). However, there is also evidence linking severe adversity with children's processing of neutral expressions. Specifically, severely deprived institutional caregiving environments have been associated with poorer accuracy, that is, poorer inhibition of responding, for neutral (but not angry) expressions (Nelson, Westerlund, McDermott, Zeanah, & Fox, 2013). Thus, studies suggest that early adversity may lead to heightened vigilance for anger, and poorer recognition of neutral expressions.

Temperament-related Shyness and Emotion Processing

Defined as biologically based individual differences in reactivity and self-regulation (Rothbart & Bates, 2006), temperament influences how children attend to, perceive, and evaluate events, and has implications for emotion processing. Shyness reflects discomfort and inhibited approach in social situations (Rothbart, Ahadi, Hersey, & Fisher, 2001). Shyness and related traits, such as fearfulness and behavioral inhibition, are associated with attention biased toward negative emotions (Pérez-Edgar et al., 2010), and interact with family environment to predict child outcomes (see Bates, Schermerhorn, & Petersen, 2012, for a review).

Raver et al. (2014) suggested that children with fearful, inhibited traits may be more susceptible to environmental influences, and that interparental aggression's influence on emotion recognition may be stronger for these children. Although their model tests did not support this, other studies have found such traits predict emotion processing. For example, when directed to rate their fear response to emotion faces, adolescents who were behaviorally inhibited showed greater amygdala activation to the faces than non-inhibited adolescents (Pérez-Edgar et al., 2007). Several studies have also examined associations of anxiety, which is related to temperamental shyness (Bates, Maslin, & Frankel, 1985), with emotion processing. For example, adolescents who had been diagnosed with anxiety, and who were identified as behaviorally inhibited, were more inclined than other adolescents to identify face images morphed between angry and fearful as fearful (Reeb-Sutherland et al., 2015). In another study, youth with anxiety disorders showed poorer recognition of emotion faces (Easter et al., 2005). Further, compared with non-anxious children, socially anxious children were less accurate in classifying neutral expressions (Melfsen & Florin, 2002). Thus, we anticipated that shy traits may strengthen links between interparental conflict and children's emotion recognition.

Conceptual Framework

As described by Crick and Dodge (1994) in their social information-processing model, children progress through a series of information-processing steps when encountering social situations. Importantly, social information-processing patterns have been shown to have substantial implications for links between severe adversity and child outcomes (e.g., Dodge, Pettit, Bates, & Valente, 1995). Of particular relevance to the current study, the first step, encoding, involves selecting information to attend to from the host of cues present in the external environment and within the child. This selection process may be influenced by children's past socially significant experiences (such as interparental conflict), as well as their biologically based traits (including shyness). For example, exposure to negative interparental conflict may lead to greater vigilance for potential threat cues, such as angry faces, relative to other facial expressions of emotion. Thus, interparental conflict and temperament may shape perceptual and attentional processes in social situations. The second step, interpretation, involves storing the encoded information in memory, analyzing the social situation, and drawing inferences about others' perspectives on the situation, as well as other sub-processes. These processes are also influenced by past social experiences. For this reason, children's analysis of social information would be expected to be influenced by children's histories of experiences in the interparental relationship, and children's experiences with negative interparental conflict may increase children's tendencies to interpret neutral, potentially ambiguous facial expressions as angry. Additionally, negative interparental conflict experiences may increase the likelihood of storing anger-relevant information in memory, potentially influencing processing of subsequent social situations. In addition, experiences with interparental conflict may also influence children's understanding of, and assumptions about, others' perspectives on a situation; for example, experiences with negative conflict between parents may lead children to infer that social partners

are angry, particularly when the cues needed for accurate interpretations are insufficient or ambiguous. Further, shy temperament traits may serve to strengthen each of these tendencies. Together, these processes would be expected to result in greater difficulty accurately recognizing interpersonal angry or neutral facial expressions.

Previous theoretical and empirical work (e.g., El-Sheikh, 1994; Pollak et al., 2000; Raver et al., 2014; Susman, 2006) provides additional basis for anticipating that interparental conflict could alter children's emotion processing. Raver et al. (2014) described how severe adversity may lead children to respond to events in ways that are adaptive in the short term, because they offer temporary protection from threat, but these responses may be maladaptive in the long term, because they may involve overly vigilant behavior in non-threatening situations and ultimately lead to poorer psychological functioning. Further, severe adversity may alter children's abilities to recognize signs of threat and safety, impairing children's emotion recognition (Raver et al., 2014). We anticipated that conflict between parents would also predict poorer emotion processing. In addition to violence and aggression, interparental conflict includes non-aggressive behaviors, such as pursuit, submission, and withdrawal (Cummings, Goeke-Morey, Papp, & Dukewich, 2002). That is, interparental conflict exposure is a less severe form of adversity than those that have been the focus of many studies of emotion recognition. However, interparental conflict has implications for a much larger portion of the child population. For example, in one community sample, nearly 89% of children witnessed at least one conflict between their parents in a typical 15-day period, and on average, children witnessed five conflicts during that time (maximum = 24) (Cummings, Goeke-Morey, & Papp, 2003). Whereas we know that severe forms of adversity alter children's emotion recognition, a major objective of the current study is

to determine whether interparental conflict, a much less severe form of adversity, is also a sufficiently strong stimulus to alter children's emotion recognition.

Other work provides additional basis for anticipating interparental conflict would predict emotion processing. Because children have limited capacities to attend and respond to events, events that are especially significant are prioritized for children's processing resources (Pollak, Vardi, Bechner, & Curtin, 2005). Interparental conflict is of great significance to children. For example, one study found children ranked interparental conflict as the third most distressing event on a list of 20 events that make them "feel bad, nervous or worry" (Lewis, Siegel, & Lewis, 1984, p. 117). Thus, interparental conflict cues may be prioritized for children's limited information processing resources.

Our conceptualization is that parents' emotions during conflict are especially significant to children. Specifically, our conceptualization is as follows: First, parents' emotions during marital conflict are of considerable significance, with negative emotions consistently predicting subsequent marital distress and, ultimately, marital dissolution (Gottman & Levenson, 1992; Gottman & Levenson, 1999; Levenson & Gottman, 1985). Second, outcomes like marital distress and divorce are very important to children. Third, as a result, parents' emotions, as cues that predict adverse, important marital outcomes, are likely important targets for children's limited processing resources. That is, because parents' emotions are important predictors of later adverse marital functioning, parents' emotions are likely important cues for children to process. Fourth, therefore, children's experiences with their parents' emotions during marital conflict, which are likely significant cues for children, would be expected to shape children's emotion recognition. Consistent with this conceptualization of parents' emotions during conflict as a very important cue for children to process, parents' emotions during conflict have been found to

predict children's responses to conflict, even when parents' conflict behaviors (e.g., verbal hostility) are controlled for statistically (e.g., Cummings et al., 2002). In summary, it is likely that children learn to associate parents' emotional distress with escalation of interparental difficulties and potentially with threats of marital separation. This may alter children's emotion recognition.

Further, children feel emotionally distressed when their parents have conflict (Rhoades, 2008), and affective arousal is thought to impair higher order cognitive processing (Kochanska, 1997), a conceptualization that is supported by neuroscience findings (Henderson, 2010). Thus, children's emotional arousal during interparental conflict might alter processing of parents' emotion cues, potentially decreasing children's emotion recognition accuracy. Further, shy traits involve greater tendencies to experience emotional arousal. Thus, the arousal experienced by shy children may amplify emotion processing difficulties that may result from interparental conflict.

The Present Study

The current study builds on previous work in several ways. First, whereas previous studies have primarily examined links between emotion recognition and children's exposure to physical abuse and neglect, in the current study, we examined links with interparental conflict. Compared with abuse and neglect, interparental conflict is a less severe, less traumatic experience, but it is also more prevalent, and therefore has implications for a larger portion of the population. Moreover, we examined several aspects of conflict, including children's perceptions of threat and self-blame regarding their parents' conflicts, in addition to conflict exposure. Second, this study expands on the few previous studies of associations between interparental relationship functioning and child emotion processing by examining differences in recognition of anger, happiness, and neutrality. Third, whereas previous studies have examined children's

recognition of emotions posed by individuals, in the current study, children's recognition of interpersonal emotion was examined using stimuli depicting a couple, which is more directly relevant to interparental conflict.

Previous work (e.g., Camras et al., 1988; El-Sheikh, 1994; Pollak et al., 2000; Raver et al., 2014) and the conceptualization above led to the expectation that higher interparental conflict-related scores (conflict exposure, threat perceptions, and self-blame) would predict impaired abilities to recognize emotion, across emotion categories. In addition, findings that abused children more readily identified anger (e.g., Pollak & Sinha, 2002) led to the hypothesis that higher conflict-related scores would predict more accuracy identifying angry emotions. In addition, findings that children in severely deprived caregiving environments had more difficulty than other children correctly inhibiting responses on neutral trials (Nelson et al., 2013) also led to the hypothesis that higher conflict-related scores would predict less accuracy identifying neutral emotions. Further, based on theoretical perspectives emphasizing the roles of temperament and adversity in altering emotion processing (Raver et al., 2014), and findings of poorer emotion recognition in anxious children (Easter et al., 2005), we hypothesized that shy traits would interact with conflict to predict especially poor emotion recognition.

In addition, because differences in response speed could explain differences in emotion recognition, we examined children's reaction times (RT). Differences in RTs could, for example, be a function of differences in processing time. In previous studies, compared with control children, longer RTs were found for maltreated children (Pollak, Cicchetti, Klorman, & Brumaghim, 1997) and anxious children (Melfsen & Florin, 2002). Thus, we expected higher conflict-related scores, by themselves, and in interaction with shyness, to predict longer RTs.

Method

Participants

Participants were 101 children, ages 9 to 11 years, and their mothers living in the northeastern United States. To be eligible, children had to live with their biological parents, who had to be married to each other, and children had to read at a 4th grade level or higher. The sample was recruited from the community via information distributed through local schools, newspaper and magazine ads, flyers and booths in public places, and letters sent to families with a child in the target age range. The study was approved by the Institutional Review Board (IRB). Mothers provided informed consent and 11-year-old children provided assent (per the IRB, younger children did not provide assent, but the procedures were described to them and they were encouraged to ask questions). Participants were paid for their time. Emotion recognition data were missing for two children (one who declined to complete the emotion recognition task, and one due to technical difficulties), resulting in a sample of 99 mother-child dyads.

Participating children (56 males) had a mean age of 10.49 years (*SD* = 0.87). Representative of the geographic area, 90% of the children were identified as Caucasian, 7% as multiracial, 1% as American Indian or Alaska Native, and 1% as Asian. Nearly 56% of mothers reported yearly household incomes of at least $80,000, with 7% indicating incomes of $40,000/year or less, 13% between $40,001 and $65,000, 22% between $65,001 and $80,000, and 2% not reporting income. The modal level of maternal education was completion of a bachelor's degree, and the mean length of marriage was nearly 15 years.

Experimental Stimuli: Creation and Screening

We created a novel stimulus set depicting interpersonal emotion. The initial stimulus pool consisted of 257 color photographs taken by a professional photographer, of two paid actors, one male and one female, both Caucasian. The actors posed as a couple and depicted interpersonal

anger, happiness, and neutrality. They were positioned in front of a black background, and oriented partway toward each other with their faces clearly in view.

Stimulus screening was conducted with an independent sample of twenty 9- to 11-year-olds. The experimental protocol for stimulus screening was approved by the IRB. Mothers provided informed consent and children provided assent. Children classified each photo as happy, angry, neutral, or indeterminate; this was a 4-option forced-choice task with no time limit. These ratings enabled us to identify photos depicting happiness, anger, and neutrality from the perspective of children in our target age range. The 30 photos classified by the most children as happy, the 30 most classified as angry, and the 30 most classified as neutral, as well as 20 practice photos, were selected. We created a flipped copy of each image, showing the actors on the opposite sides of the image from the original, and randomly selected originals and flipped copies so each actor appeared on each side an equal number of times for each emotion, so that the actors' positions would not be a confound.

Procedures

Images were presented using Presentation software (Neurobehavioral Systems, Inc., Berkeley, CA), in a three-condition equal probabilities paradigm, consisting of 90 experimental trials plus 20 practice trials. Each condition (happy, angry, neutral) was presented on 30 trials (33.33% of trials), and trial order was randomized. Each photo was presented for 1500 ms, with a randomly varying interstimulus interval of 1000 to 2000 ms, during which time a white fixation cross was presented in the middle of a black screen. Children were told they would "see some photos of some actors pretending to be a married couple. And in some of the photos they look like they're happy with each other and in some of the photos they look angry with each other, and some of the photos are in between." They were asked to hold a Logitech F310 game

controller and press one button if the actors looked angry, another button for happy, and a third button for neutral. They were encouraged to respond as quickly as possible, and they were told that the photos would disappear quickly even if no response was made.

Children's behavioral responses were used to calculate accuracy and RT. Accuracy was scored dichotomously for each trial (0 = incorrect, 1 = correct). If a child made multiple responses on a single trial, only the first response was used. Trials with no responses were treated as missing data. We created two different accuracy scores. For the primary score (referred to as Accuracy-Entire Trial; AET), children's responses were used as long as they occurred prior to the onset of the next stimulus (a period of up to 3500 ms, including the 1500-ms stimulus presentation time and 1000- to 2000-ms interstimulus interval). Although this approach allowed us to include more responses by counting responses that were made later, it also meant that a somewhat delayed response could count on some trials but not count on other trials, simply due to variability in the interstimulus interval. For example, a response made 3000 ms after stimulus onset would be counted on trials with an interstimulus interval of at least 1500 ms, but not on trials with shorter interstimulus intervals. Notably, these differences are not confounded by condition, nor by the between-subjects variables, because durations of interstimulus intervals were randomized across trials and across participants. Nonetheless, we also created a second accuracy score (referred to as Accuracy-Stimulus Presentation Only; ASPO), which used the first response made within the 1500-ms stimulus-presentation period only. We also created two corresponding RT measures: one reflecting the first response regardless of when it was executed within the trial (RT-Entire Trial; RTET), and the other reflecting the first response made within the 1500-ms stimulus-presentation period only (RT-Stimulus Presentation Only; RTSPO). We

averaged across trials within condition to yield continuously scaled accuracy and reaction time scores for each condition.

Measures

Interparental conflict. Children provided reports of interparental conflict and their perceptions of threat and self-blame regarding interparental conflict using the Children's Perceptions of Interparental Conflict Scale (CPIC; Grych, Seid, & Fincham, 1992). The CPIC consists of 48 items completed using a 3-point scale consisting of 0 (*false*), 1 (*sort of true*), and 2 (*true*), and higher scores reflect more conflict, threat, and self-blame. The Conflict Properties subscale is a 16-item measure of conflict frequency, intensity, and resolution. It includes such items as "My parents get really mad when they argue." The 12-item Threat subscale assesses perceptions that conflict could escalate into worse problems (e.g., "When my parents argue I worry that they might get divorced."). The 9-item Self-Blame subscale assesses the extent to which children feel they are to blame for their parents' conflict (e.g., "My parents blame me when they have arguments."). The CPIC is a widely used questionnaire that has demonstrated good psychometric properties (Grych et al., 1992). Cronbach's αs in this sample were 0.89 for Conflict Properties, 0.79 for Threat, and 0.72 for Self-Blame. Levels of interparental conflict in our sample were similar to, but slightly lower than, those of other community samples. Our sample had a mean CPIC Conflict Properties score of 9.05 (*SD* = 6.29), compared with a mean of 10.91 (*SD* = 7.04) in Cummings, Schermerhorn, Davies, Goeke-Morey, and Cummings (2006), for example.

Temperamental shyness. Mothers reported child shyness on the Temperament in Middle Childhood Questionnaire (TMCQ; Simonds & Rothbart, 2004). TMCQ items are answered on a 5-point scale from 1 (*Almost always untrue*) to 5 (*Almost always true*). The

Shyness subscale consists of 5 items (e.g., "Becomes self-conscious when around people"). The TMCQ has good reliability (Simonds & Rothbart, 2004). In our sample, Cronbach's α for Shyness was 0.83. The level of Shyness in our sample (M = 2.61; SD = 0.86) was very similar to that of other samples. For example, the mean Shyness score in Simonds' (2007) study was 2.37 (SD = 0.95).

Data Analyses

Mixed models were computed in SPSS (IBM SPSS Statistics, Version 22.0.0.0), using the identity covariance structure, with condition (angry, happy, neutral) nested within individuals, and with accuracy as the dependent variable. Although there was some missing data (ranging from 3 missing TMCQ Shyness cases to 8 missing CPIC Threat cases), analyses used REML to accommodate missing data. The independent variables and non-categorical covariates were mean-centered to facilitate interpretation of interactions.

First, the best-fitting model for the primary analyses was identified by comparing preliminary models' fit using the Bayesian information criterion (BIC) fit index (Schwarz, 1978). The BIC is a relative fit index, with smaller BIC values indicating better fit. If BIC values of two models differ by 10 or more, that provides very strong evidence of better fit for the model with the smaller BIC (Raftery, 1995). The first model, with only a random intercept, had a BIC of -141.06. Adding condition produced a much better fit, with a BIC of -206.62. Next the maximum likelihood (ML) method was compared with the restricted maximum likelihood (REML) method used in the foregoing models. ML produced little difference in fit (BIC = -208.68); thus, REML was used for subsequent analyses. Child age and sex, and family socioeconomic status (SES, a composite of standardized maternal education and family income; intercorrelation: r = .51, p <

.001), were added as covariates. Although these covariates worsened model fit (BIC = -197.43), they were included in the models because of their potential importance as covariates.

Mixed models were then computed to test our hypotheses that: 1) higher interparental conflict-related scores would predict less accuracy across emotions (first-order effect of interparental conflict); 2) higher interparental conflict-related scores would predict more accuracy on angry trials and less accuracy on neutral trials (conflict X condition interaction); 3) higher interparental conflict-related scores would interact with higher levels of shyness to predict less accuracy across emotions (conflict X shyness interaction); and 4) higher interparental conflict-related scores, and their interaction with higher levels of shyness, would predict longer RTs (first-order effect of conflict, conflict X shyness interaction effect). As interaction terms were added, lower-order terms were retained. Thus, tests of effects were computed controlling for each other, making the tests more conservative and reducing the number of tests computed. Further, differences between individual conditions (e.g., angry vs neutral) and tests of simple slopes were evaluated only if the omnibus tests were significant.

Results

Table 1 presents descriptives and intercorrelations using AET (Accuracy-Entire Trial, accuracy of the first response at any point during the trial) and RTET variables (RT-Entire Trial, RT of the first response at any point during the trial). The interparental conflict-related measures (Conflict Properties, Threat, and Self-blame) were significantly intercorrelated. The measures of overall accuracy and accuracy on each of the trial types were also significantly intercorrelated, except that accuracy on happy trials was only marginally correlated with accuracy on angry trials. These intercorrelations for accuracy suggest that children who tend to recognize one emotion type accurately tend to recognize other emotion types accurately. Age tended to

correlate positively with accuracy and negatively with RT. Descriptives and intercorrelations were very similar for ASPO and RTSPO (for responses during stimulus presentation only), with the exceptions that 1) mean RTs were longer for RTET than for RTSPO (as would be expected), and 2) accuracy-RT correlations were weaker for responses during stimulus presentation only than for responses made at any point during stimulus presentation or the interstimulus interval, suggesting the two sets of variables provide unique information.

Tests of Interparental Conflict

The first step was to test the hypotheses regarding a first-order effect of conflict and an interaction between conflict and condition. In the model testing children's threat perceptions regarding interparental conflict (CPIC Threat), there was a significant first-order condition effect on AET. Table 2 shows the results with neutral trials as the reference condition, and the rows for angry and happy present results for those two conditions relative to the neutral condition. For example, the row for happy trials (Estimate = 0.15) indicates that children were more accurate on happy than on neutral trials (the reference condition) and this difference was statistically significant. In addition, when considering angry trials as the reference condition (not shown in Table 2), children were more accurate on happy than on angry trials, $t(178) = 8.80$, $p < .001$. Regarding the hypotheses, although the first-order effect of threat was not significant, there was a significant threat X condition interaction effect on AET. To probe the interaction, the simple slopes were evaluated for each condition (Aiken & West, 1991). The simple slope for the threat-AET association in the neutral condition was significant, $t(224.32) = -2.59$, $p < .05$, indicating children who perceived greater threat were less accurate in recognizing neutral expressions. The simple slopes for the threat-AET associations in the happy and angry conditions were not significant. Further, the estimate for the difference between the happy and neutral slopes was

positive and significant, indicating that the threat-AET association was more positive on happy than on neutral trials (shown in the row labeled "Threat X happy condition" in Table 2). In other words, children who reported greater threat were also less accurate, on average, in identifying neutral expressions relative to happy ones. No other simple slopes comparisons were significant. In the model for ASPO, results were similar, but the threat X condition interaction effect did not reach significance (p = .08). There were no significant first-order or interaction effects for CPIC Conflict Properties or Self-Blame for either AET or ASPO.

Tests of Interparental Conflict X Shyness Interactions

Next, models were tested examining shyness as a moderator of threat-emotion recognition associations. For AET, model tests of threat and shyness revealed a significant condition effect, as before (Table 3). In addition, although the first-order shyness effect was non-significant, the shyness X condition interaction was significant. Probing the interaction, the simple slope for the shyness-AET association was significant in the neutral condition, $t(218.59) = -2.88$, $p < .01$, indicating children who were more shy were less accurate in recognizing neutral expressions. The simple slopes in the happy and angry conditions were not significant, and the simple slope in the neutral condition differed significantly from the simple slopes in the happy and angry conditions. Thus, children who were more shy were less accurate in identifying neutral expressions compared with happy and angry ones.

Regarding the hypothesis of a conflict X shyness interaction effect, there was a significant threat X shyness interaction effect (there was no significant 3-way interaction between threat, shyness, and condition). To probe the threat X shyness interaction, a multiple linear regression of AET was computed across condition. The interaction from the regression was then probed to examine the simple slopes for the threat-AET association at the mean of

shyness and ±1 *SD*, following procedures recommended by Preacher, Curran, and Bauer (2006), using the utility for multiple linear regression 2-way interactions. The simple slopes at the shyness mean and +1 *SD* were nonsignificant, but the slope -1 *SD* was significant, $t(92) = -2.39$, $p < .05$, indicating that at low levels of shyness, low levels of threat predicted more accuracy (see Figure 1). In addition, probing the interaction at the mean of threat and ±1 *SD*, the simple slopes at the threat mean and +1 *SD* were nonsignificant, but the slope -1 *SD* was significant, $t(92) = -2.50$, $p < .05$, indicating that at low levels of threat, low levels of shyness predicted more accuracy. Results were very similar for ASPO, including a threat X shyness interaction, an overall condition effect, and a condition X shyness interaction; at the shyness mean and +1 *SD*, the threat-ASPO association was nonsignificant, but at -1 *SD*, low threat predicted more accuracy, $t(92) = -2.16$, $p < .05$. In addition, at the threat mean and +1 *SD*, the shyness-ASPO association was nonsignificant, but at -1 SD, low shyness predicted more accuracy, $t(92) = -2.63$, $p < .05$. Thus, children who had low levels of both shyness and threat were more accurate than other children across emotion categories. In contrast, children with moderate to high levels of either threat or shyness (or both) were similar to one another in their relatively low levels of accuracy.

Tests of Reaction Time

Next, the hypothesis that interparental conflict and shyness would predict longer RTs was tested. Our objective was to determine whether differences in accuracy could be a function of differences in RTs. Given the results for accuracy, we tested models with threat and the threat X shyness interaction as predictors of RTET. The model testing threat revealed a significant condition effect, $F(2, 177.25) = 75.76$, $p < .001$. Comparisons of the conditions revealed significantly longer RTs on neutral than on happy trials, $t(177.32) = 12.29$, $p < .001$, longer RTs

on neutral than on angry trials, $t(177.32) = 5.59$, $p < .001$, and longer RTs on angry than on happy trials, $t(177.11) = 6.72$, $p < .001$. A similar condition effect was obtained in the model testing the threat X shyness interaction. However, there were no significant first-order effects of threat, nor was there an interaction between threat and shyness. All results were very similar for RTSPO. Thus, our hypothesis that interparental conflict and shyness would predict longer RTs was not supported. In summary, there was very little evidence that the associations of interparental conflict and shyness with accuracy were related to differences in response time.

Inaccurate Neutral Trials

To investigate the association of higher levels of threat with poorer accuracy on neutral trials, patterns of responding on inaccurate neutral trials were tested. (Such patterns were not tested for the combination of threat and shyness, because the threat X shyness interaction effect was not specific to neutral expressions.) The purpose of this test was to determine whether threat was associated with greater tendencies to classify neutral trials as either happy or angry. Mixed models were computed in which the dependent variable was the number of neutral trials on which inaccurate responses were made, with error type (neutral trials classified as angry, neutral trials classified as happy) as a within-subjects variable, and child age, sex, and SES as covariates. For AET, there was a significant difference in the number of neutral trials classified as angry compared with the number of neutral trials classified as happy, for the sample as a whole, $F(1, 89) = 21.68$, $p < .001$. Children were more likely to classify neutral photos as angry than as happy, $t(89) = 4.66$, $p < .001$. However, there was no significant first-order effect of threat, and no significant interaction between error type and threat. Results were very similar for ASPO. Thus, there was no evidence that threat was associated with greater tendencies to classify neutral trials as either happy or angry.

Discussion

The sample as a whole was more accurate in recognizing happy expressions than angry and neutral expressions. Our hypothesis that higher interparental conflict-related scores would predict less accuracy across emotions was not supported. Although the hypothesis that greater interparental conflict would predict greater accuracy recognizing anger also was not supported, children who perceived more threat regarding their parents' conflicts were less accurate in recognizing neutrality, consistent with our hypothesis. That is, even controlling for the worse accuracy of the sample as a whole on neutral and angry trials compared to happy trials, children who perceived a high level of threat from their parents' conflicts were less accurate on neutral than on happy trials. Notably, the large majority of CPIC items focus on parents' verbal handling of conflict, as opposed to physical handling of conflict, indicating that the current results are primarily related to non-physical handling of conflict. Thus, building on studies showing associations of violence and severe forms of adversity with children's emotion processing (e.g., Pollak et al., 2000; Raver et al., 2014), the current findings suggest children's experiences with interparental conflict, specifically their perceptions of threat regarding conflict, are also associated with emotion processing.

We also hypothesized that high levels of interparental conflict and high levels of shy temperament traits would interact to predict less emotion recognition accuracy. However, the results indicated that children with *moderate to high* levels of threat, *moderate to high* levels of shyness, or both, were all relatively low in emotion recognition accuracy, and did not differ significantly from one another. In contrast, children with *low* levels of both threat and shyness were *more* accurate in recognizing emotions than other children. That is, at low levels of threat, the effect of shyness was observable. Moreover, as can be seen from Figure 1, at high levels of

threat, shyness did not alter accuracy. That is, at high levels of threat, the effect of shyness was overridden by the high threat, suggesting that high threat may be sufficient to produce poor accuracy regardless of shyness. By the same token, at high levels of shyness, threat did not alter accuracy, suggesting that high shyness may be sufficient to produce poor accuracy regardless of threat. That is, consistent with suggestions in the literature (Kochanska, 1997), emotional arousal, a more frequent state in children who perceive threat regarding interparental conflict, as well as in shy children, may interfere with processing emotions. Lastly, inconsistent with our hypothesis regarding RTs, RTs were not significantly predicted by either threat or by an interaction between threat and shyness.

The finding that perceptions of threat regarding interparental conflict predicted poorer accuracy for neutral expressions raises the question of why threat would be particularly associated with poorer recognition of neutral expressions. Children's interpretations of parents' conflict have been conceptualized as "radar systems" for detecting interparental exchanges that might foreshadow worse problems (Davies & Cummings, 2006, p. 93). If children's threat perceptions lead them to be especially vigilant for signs of trouble, that could account for our findings showing special difficulty of children with elevated threat perceptions on neutral trials. Vigilance may lead to biases to interpret neutral expressions as angry, consistent with a social information-processing perspective (Crick & Dodge, 1994), or the ambiguity of neutral expressions may simply present greater processing challenges for these children. Relatedly, Pollak et al. (2000) found maltreated children rated angry faces as similar to neutral faces, a finding they suggested could be a result of interpreting neutral faces as angry, or viewing neutral faces as concealing more negative emotions. A similar explanation could apply to children who perceive greater threat regarding their parents' conflict.

Another possibility is that children who perceived more threat may have learned through experience to view angry and happy expressions as the most useful predictors of ensuing interparental behavior, and to largely disregard neutral expressions as insignificant and unpredictive of subsequent exchanges. Consistent with this, a recent investigation found children exposed to elevated interparental conflict generated larger P3 event-related potential (ERP) components in response to both angry and happy photos than neutral photos, but children exposed to less conflict did not (Schermerhorn, Bates, Puce, & Molfese, 2015). The P3 is a measure of neural activity that reflects stimulus salience. Thus, neutrality may be less salient to these children than happy and angry expressions.

The lack of support for our hypothesis that children exposed to more conflict would have greater accuracy for anger stimuli is noteworthy, given studies finding abused children show enhanced perception of angry faces (e.g., Pollak & Sinha, 2002). It is possible that, whereas interparental conflict may not predict greater *accuracy* in identifying anger, such conflict could predict better *perception* of anger (e.g., accurate perception based on fewer visual cues). Although perceptual processes are certainly an element of the social information-processing stages thought to be relevant to the current study, our examination of perceptual processes was only indirect, combined with other cognitive processes to produce emotion processing. Future research should directly address the possibility that perception of emotion may be altered by experiences with interparental conflict.

By identifying associations of emotion processing with interparental conflict and with shy temperament traits, the findings of the current study can help inform theoretical perspectives that have addressed the role of emotion processing in associations between family adversity, vulnerabilities, and child development (Susman, 2006). Our conceptualization is that signs of

parents' emotions may be prioritized as a focus of children's information processing resources. This conceptualization is based on studies showing spouses' emotions during conflict are strongly associated with marital distress and later dissolution (Gottman & Levenson, 1992; Levenson & Gottman, 1983). In one study, for example, spouses' reciprocity of negative emotions predicted marital dissatisfaction three years later, with several correlation coefficients larger than 0.60, and one as large as 0.96, indicating substantial linkage over this time (Levenson & Gottman, 1985). Given that partners' emotions during conflict have considerable implications for marital distress and separation, and that marital distress and separation have considerable implications for children, partners' emotions during conflict are likely significant to children. Further, considering the interference of emotional arousal with cognition, which would be especially heightened for children with shy traits, we expected that elevated exposure to interparental conflict would impair children's emotion processing, and that shyness would strengthen this effect.

An important consideration is that we examined children's perceptions of threat regarding interparental conflict, a fairly subjective construct, and there are likely individual differences in what children consider threatening. Further, even parents in marriages that are functioning well typically have at least mild conflict at times. It is possible that some children in these families may perceive high levels of threat even from mild, infrequent conflict. In particular, shyness may have considerable implications for children's threat perceptions, given that shyness reflects discomfort in social situations (Rothbart et al., 2001), and acts as a filter altering children's interpretations of social situations. Thus, children who have high levels of shyness might be especially likely to perceive threat even from normative levels of interparental conflict. Children who are more shy may have more difficulty dealing with interparental conflict,

and may be more likely to be distressed by it, as well as being more threatened by it, and therefore more vigilant for signs of threat from interparental conflict. These children may have special difficulty recognizing emotion, as such vigilance may make it especially challenging to recognize neutral displays.

Our study also raises some interesting methodological questions and suggests some developmental considerations. For example, we would propose that children's emotion recognition on this task (i.e., recognition of interpersonal emotion) would probably be relatively closely related to their emotion recognition if we had also presented photos of individuals posing emotional expressions. However, emotion recognition on our task is probably a better measure of their recognition of emotion during interparental conflict situations than recognition of individuals' emotional expressions would be. Thus, our conceptualization is that the photos in our task are more directly relevant to children's experiences with conflict between their parents. At the same time, it would be very informative to know how strongly interparental conflict experiences are related to recognition of individual emotional expressions. If the two are highly related to one another, that would suggest that children's experiences with interpersonal emotions may lead to changes in children's perception and recognition of emotion more generally. Alternatively, finding that the two are only modestly correlated would suggest that children develop emotion processing schemas that are specialized to specific contexts. This would be a very interesting direction for future research.

Regarding response time, neither threat nor the threat X shyness interaction predicted RT. Although it is difficult to interpret null results, they may suggest that the poorer accuracy of children who had higher threat or shyness scores was not simply an artifact of responding faster than other children, before they had time to process the stimuli sufficiently. At the same time, the

lack of significant RT findings may suggest that these children also were not slower to respond than other children, taking more time to process the stimuli. In summary, children's response time does not appear to explain the differences in accuracy associated with conflict or shyness.

This study has a number of limitations. One limitation is that the sample was relatively homogeneous in terms of race and socioeconomic status. The homogeneity of the sample limits our ability to generalize from this study to more diverse populations. Moreover, the stimuli depicted only Caucasian actors. This is a limitation because previous work has shown that the race and ethnicity of both the perceiver and the individual posing the emotion influence emotion recognition accuracy (Elfenbein & Ambady, 2002). Specifically, emotion recognition is most accurate when the perceiver and actor are of the same racial and ethnic group. Thus, children in our sample who were not Caucasian may have been less accurate in recognizing emotion. Future research should include stimuli depicting individuals of different races and ethnicities, and it should include samples with greater racial and socioeconomic diversity, so that these research questions can be addressed in a broader population. Moreover, all of the stimuli depicted the same couple. Although the inclusion of the same couple in all stimuli is common, this could have affected our results if idiosyncratic aspects of the actors' portrayals systematically elicited different responses from children as a function of their experiences with interparental conflict or shyness. Although such effects are likely small, they should be addressed in future work by using stimuli depicting multiple couples.

In addition, the study included few measures of other family-related stressors, such as harsh parenting, limiting our ability to compare the predictive strength of interparental conflict with that of other family stressors in associations with emotion recognition. However, it is noteworthy that SES, which was included in all models, did not significantly predict accuracy in

any of the models. This suggests that children's perceptions of threat predict children's emotion recognition more strongly than SES does. Another limitation of the study was its cross-sectional design. Important directions for future work include longitudinal tests of bidirectional associations among interparental conflict, shyness, and emotion recognition.

Further, for children's reports of interparental conflict, it is possible that children's verbal skills could have related to their responses. The CPIC was designed for children ages 9 to 12 years of age, but has also been used with younger and older children. In our study, an experimenter explained the CPIC questionnaire and answer choices to children, and then children completed the CPIC on paper; all children were able to complete all or nearly all items, suggesting that verbal skills did not hinder their completion of the questionnaire. However, it is possible that children's verbal skills could be related to children's responses to the CPIC, which is a possible direction for future research. Lastly, although not necessarily a limitation, it is worth noting that our eligibility criteria required parents to be married, limiting the generalizability of our findings to families in which the parents are married, as opposed to cohabiting. In planning the study, we thought there may be important distinctions between married and cohabitating biological parents, and we anticipated being unable to recruit a sufficient sample size of each to test for such differences. Although we believe the results could apply equally to children living with cohabitating biological parents, additional research would be needed to determine whether this is the case.

Despite these limitations, the current study makes several contributions to the literature. It extends previous research on emotion recognition in contexts of highly adverse caregiving environments to the context of interparental conflict, a less severe, but more common form of adversity. The results point to the role of children's perceptions of threat regarding interparental

conflict in shaping children's processing of interpersonal emotion, particularly for interpersonal neutrality. Further, they suggest shy temperament traits strengthen the influence of children's threat perceptions on emotion processing.

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Table 1.

Means, Standard Deviations, and Intercorrelations among the Variables

	1	2	3	5	7	8	9	10	11	12	13	14	15
1 CPIC TH	--												
2 CPIC CP	0.56***	--											
3 CPIC SB	0.22*	0.27**	--										
5 TMCQ Shy	0.05	0.09	-0.08	--									
7 AET	-0.12	0.01	-0.05	-0.11	--								
8 AET Angry	-0.03	0.12	0.10	0.01	0.73***	--							
9 AET Happy	0.07	-0.01	-0.09	0.06	0.60***	0.20†	--						
10 AET Neutral	-0.20†	-0.07	-0.12	-0.23*	0.86***	0.35***	0.42***	--					
11 RT	-0.13	-0.20†	-0.12	-0.08	-0.30**	-0.31**	-0.33***	-0.12	--				
12 RT Angry	-0.05	-0.22*	-0.18†	-0.11	-0.27**	-0.42***	-0.16	-0.05	0.88***	--			
13 RT Happy	-0.17	-0.18†	-0.11	-0.08	-0.37***	-0.28**	-0.49***	-0.19†	0.89***	0.67***	--		
14 RT Neutral	-0.13	-0.14	-0.04	-0.02	-0.23*	-0.15	-0.26*	-0.15	0.91***	0.69***	0.74***	--	
15 Age	-0.15	-0.06	0.02	-0.01	0.22*	0.04	0.17†	0.27**	-0.28**	-0.22*	-0.32**	-0.23*	--
M	7.38	9.05	1.67	2.61	0.80	0.72	0.91	0.76	1120.99	1126.40	1047.98	1190.42	10.49
SD	4.57	6.29	2.15	0.86	0.12	0.18	0.10	0.21	128.55	145.16	136.18	149.94	0.87

Note. n = 91 – 99. CPIC = Children's Perceptions of Interparental Conflict Scale; TH = Threat; CP = Conflict Properties; SB = Self-blame; TMCQ = Temperament in Middle Childhood Questionnaire; AET = Accuracy of first response at any point during trial; RTET = RT for first response at any point during trial. RTs are in ms. $^{\dagger}p < .10$, $*p < .05$, $** p < .01$, $*** p < .001$.

Table 2.

Mixed Effects Results for CPIC Threat Predicting Accuracy-Entire Trial

Predictor	*F*(df)	Estimate	Standard Error	*t* value (df)	*p* value
Intercept	4234.00 (1, 86)				< 0.001
Condition	43.43 (2, 178)				< 0.001
Angry condition		-0.04	0.02	-1.75 (178)	0.08
Happy condition		0.15	0.02	7.06 (178)	< 0.001
Neutral condition		0[a]	0		
Threat	1.57 (1, 86)				0.21
Threat X condition	3.15 (2, 178)				< 0.05
Threat X angry condition		0.01	0.00	1.81 (178)	0.07
Threat X happy condition		0.01	0.00	2.41 (178)	< 0.05
Threat X neutral condition		0[a]	0		
Sex	3.94 (1, 86)				0.05
Male		-0.05	0.03	-1.98 (86)	0.05
Female		0[a]	0		
Age	3.09 (1, 86)				0.08
SES	1.94 (1, 86)				0.17

Note. [a] = This parameter is set to zero because the neutral condition is the reference category. Threat = CPIC Threat; Accuracy-Entire Trial = Accuracy of first response at any point during trial.

Table 3.

Mixed Effects Results for CPIC Threat X TMCQ Shyness Interactions

Predictor	*F*(df)	Estimate	Standard Error	*t* value (df)	*p* value
		Accuracy-Entire Trial			
Intercept	4470.10 (1, 84)				< 0.001
Condition	44.98 (2, 174)				< 0.001
Angry condition		-0.04	0.02	-1.88 (174)	0.06
Happy condition		0.15	0.02	7.11 (174)	< 0.001
Neutral condition		0[a]	0		
Threat	1.98 (1, 84)				0.16
Threat X condition	2.84 (2, 174)				0.06
Threat X angry condition		0.01	0.00	1.64 (174)	0.10
Threat X happy condition		0.01	0.00	2.32 (174)	< 0.05
Threat X neutral condition		0[a]	0		
Shyness	1.20 (1, 84)				0.28
Shyness X condition	4.58 (2, 174)				< 0.05
Shyness X angry condition		0.06	0.02	2.68 (174)	< 0.01

Shyness X happy condition		0.06	0.02	2.56 (174)	< 0.05
Shyness X neutral condition		0[a]	0		
Threat X shyness	5.16 (1, 84)				< 0.05
Threat X shyness X condition	0.82 (2, 174)				0.44
Threat X shyness X angry condition		0.01	0.01	1.19 (174)	0.24
Threat X shyness X happy condition		0.00	0.01	0.20 (174)	0.84
Threat X shyness X neutral condition		0[a]	0		
Sex	6.56 (1, 84)				< 0.05
Male		-0.07	0.03	-2.56 (84)	< 0.05
Female		0[a]	0		
Age	4.79 (1, 84)				< 0.05
SES	2.01 (1, 84)				0.16
Accuracy-Stimulus Presentation Only					
Intercept	4226.92 (1, 84)				< 0.001
Condition	40.77 (2, 174)				< 0.001
Angry condition		-0.02	0.02	-0.95 (174)	0.34
Happy condition		0.15	0.02	7.30 (174)	< 0.001

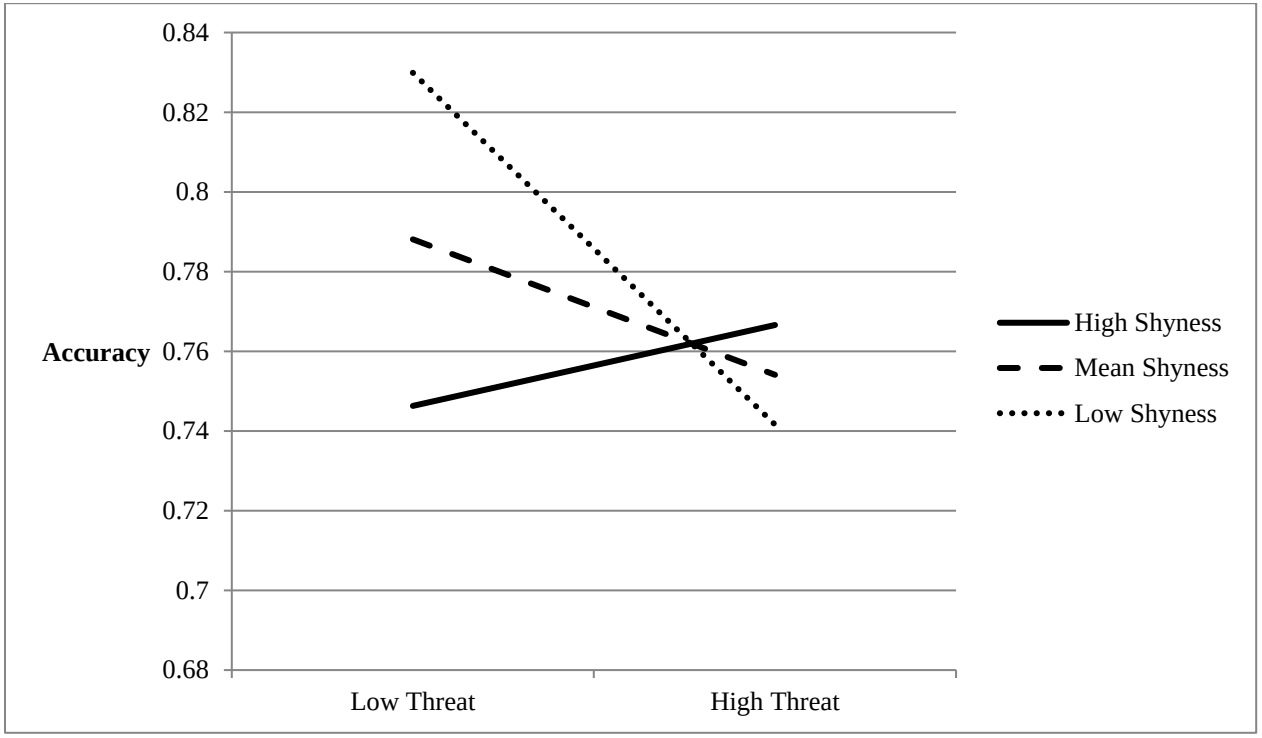
Neutral condition		0[a]	0		
Threat	1.22 (1, 84)				0.27
Threat X condition	2.26 (2, 174)				0.11
Threat X angry condition		0.01	0.00	1.29 (174)	0.20
Threat X happy condition		0.01	0.00	2.11 (174)	< 0.05
Threat X neutral condition		0[a]	0		
Shyness	1.76 (1, 84)				0.19
Shyness X condition	3.72 (2, 174)				< 0.05
Shyness X angry condition		0.06	0.02	2.31 (174)	< 0.05
Shyness X happy condition		0.06	0.02	2.41 (174)	< 0.05
Shyness X neutral condition		0[a]	0		
Threat X shyness	4.61 (1, 84)				< 0.05
Threat X shyness X condition	0.72 (2, 174)				0.49
Threat X shyness X angry condition		0.01	0.01	1.12 (174)	0.26
Threat X shyness X happy condition		0.00	0.01	0.19 (174)	0.85
Threat X shyness X neutral condition		0[a]	0		
Sex	5.29 (1, 84)				< 0.05

Male		-0.06	0.03	-2.30 (84)	< 0.05
Female		0[a]	0		
Age	5.31 (1, 84)				< 0.05
SES	1.57 (1, 84)				0.21

Note. [a] = This parameter is set to zero because the neutral condition is the reference category. Threat = CPIC Threat; Shyness = TMCQ Shyness; Accuracy-Entire Trial = Accuracy of first response at any point during trial; Accuracy-Stimulus Presentation Only = Accuracy of first response during stimulus presentation only.

Figure 1.

Interaction Effect of CPIC Threat and TMCQ Shyness on Accuracy-Entire Trial



Note. Accuracy-Entire Trial = Accuracy of first response at any point during trial.