Attention bias to emotional information in children as a function of maternal emotional disorders and maternal attention biases

Allison M. Waters a,*, Kylee Forrest a, Rosie-Mae Peters a, Brendan P. Bradley b, Karin Mogg b

a School of Applied Psychology, Griffith University, Australia
b Psychology, University of Southampton, UK

1. Introduction

Children of parents with emotional disorders have an increased risk for developing anxiety and depressive disorders (e.g. Micco et al., 2009; Weissman et al., 2006). Parental depression is associated with a threefold increase in an individual's risk for developing a depressive episode during adolescence (Williamson, Birmaher, Axelson, Ryan, & Dahl, 2004), and maternal depression is linked with an earlier onset and more severe course of depression in offspring (Lieb, Isensee, Hofler, Pfister, & Wittchen, 2002). Similarly, offspring of parents with anxiety disorders are at 3.5 (range 1.3–13.3) times greater risk for anxiety disorders than are offspring of non-anxious parents (e.g., Merikangas, Avenevoli, Dierker, & Grillon, 1999). However, the mechanisms underlying this risk to offspring are not well understood. Children's exposure to maternal cognitive biases might be one factor influencing offspring risk for emotional disorders (Goodman & Gotlib, 1999).

Cognitive theories propose that individuals with emotional disorders, and those at risk for their development, selectively attend to negative stimuli and/or fail to attend to positive stimuli (Beck, 1967; Eysenck, 1997; Mogg & Bradley, 1998; Teasdale, 1988; Williams, Watts, MacLeod, & Mathews, 1997). Empirically, it has been repeatedly demonstrated that emotional disorders are linked with attention biases. For example, increased attention bias to threat is associated with both high levels of anxiety symptoms and a range of anxiety disorders (e.g., see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007 for a review) while increased attention bias to negative information, and a reduced bias for positive information has been repeatedly found in depression (e.g., Gotlib & Joormann, 2010; Joormann & Gotlib, 2007; Browning, Holmes, Charles, Cowen, & Harmer, 2012). Thus, if mothers have a lifetime history of an emotional disorder and...
dysfunctional attention biases (e.g. increased bias for negative information and/or reduced bias for positive information), their offspring may be more likely to develop attention biases favouring negative information and to develop emotional disorders later in life.

Previous studies of high-risk children suggest that attention biases may be cognitive markers of risk for emotional disorders. For example, children of mothers with a lifetime history of depression showed greater attention bias to negative faces, and a reduced bias for positive faces, compared with children of mothers with no history of emotional disorders (i.e., Joormann, Talbot, & Gotlib, 2007). Daughters of mothers with a lifetime history of depression have also showed greater attention to sad faces than children of never-depressed mothers, while no group differences were observed for positive faces (i.e., Kujawa et al., 2011). In both of these studies, attention bias was assessed following negative mood induction. In other studies (not using mood induction), children of mothers with a lifetime history of depression showed greater avoidance of sad faces than children of never-depressed mothers and no effect for angry or happy faces (i.e., Gibb, Benas, Grassia, & McGearry, 2009), while children of mothers with lifetime panic disorder showed increased bias towards threat stimuli (i.e., Mogg, Wilson, Hayward, & Bradley, 2012). Attention bias for positive stimuli was not assessed.

Therefore, evidence to date regarding the direction of attention biases in high-risk children is mixed in terms of biases towards versus avoidance of negative information. One factor that could be contributing to these mixed findings is that attention biases of high-risk children are influenced by the attention biases exhibited by their mothers (Goodman & Gotlib, 1999). That is, high-risk children may exhibit an attention bias for negative information if their mothers also preferentially attend to negative information and/or ignore positive information.

Therefore, the aims of the present study were to examine (a) attention biases for emotional information in children as a function of mothers’ lifetime history of emotional disorders, and (b) mothers’ own attention biases for emotional information. It was hypothesised that (1) attention bias for negative information would be greater in high-risk children (i.e. offspring of mothers with a lifetime history of emotional disorders) compared to low-risk children; and (2) within high-risk children, attention bias to negative information would be greater in children whose mothers have an increased attention bias for negative stimuli, or lack of an attention bias for positive stimuli.

2. Method

2.1. Participants

One hundred and six parent-child dyads were initially assessed to participate in this study which was approved by the Griffith University Human Research Ethics Committee. They were recruited through community advertisements, primary school and university notices and newsletters, local newspapers, GPs, and community mental health clinics as part of a larger study on risk factors for the development of emotional disorders in children (see Waters, Peters, Forrest, & Zimmer-Gembeck, 2014). Initial exclusion criteria for the present study included (a) the child having a psychiatric disorder, including an anxiety or mood disorder, chronic medical condition, intellectual impairment, pervasive developmental disorder, bipolar disorder, oppositional defiant disorder or psychosis, (b) the mother having a past or current chronic medical condition, intellectual impairment, bipolar disorder, psychosis or any psychiatric disorder other than anxiety and unipolar depression, and (c) if the participating parent was not the child’s biological mother. Of the 106 dyads assessed, 28 were excluded due to the child meeting criteria for an anxiety disorder (they were referred for treatment); 3 were excluded due to incomplete diagnostic assessment data, 5 were excluded due to the child’s biological mother being unable to participate (2 mothers due to divorce; 1 mother was deceased; 2 mothers were unavailable), and 3 were excluded due to incomplete attention bias data (bias scores were not calculated if more than 50% of RT data were missing, consistent with previous research) (Roy et al., 2008; Salum et al., 2013). Data from some children assessed for this study, but none of the mothers, were included in a larger dataset, (Waters, Bradley, & Mogg, 2014), which was used to address a separate research question, unrelated to the questions examined here.

The final sample of 67 dyads included 29 low-risk dyads (mothers and children without psychiatric disorder) and 38 high-risk dyads, of which 24 mothers had a principal lifetime diagnosis of an anxiety disorder and 14 mothers had a principal lifetime diagnosis of a depressive disorder, with their children having no psychiatric disorder. Five mothers had principal generalised anxiety disorder (GAD), 1 had obsessive-compulsive disorder (OCD), 4 had social phobia, 6 had specific phobia, 2 had panic disorder, 1 had post-traumatic stress disorder (PTSD), 1 had anxiety disorder not otherwise specified, and 1 had major depressive disorder (MDD). Numbers of past principal diagnoses were 1 with OCD, 1 with specific phobia, 1 with separation anxiety, 1 with PTSD, and 13 with MDD. Of the 24 mothers with a principal lifetime diagnosis of an anxiety disorder, 13 had comorbid lifetime anxiety diagnoses, 3 had comorbid lifetime anxiety and depressive disorders, 1 had comorbid lifetime depressive disorder, and 7 mothers had no comorbid diagnoses. Of the 14 mothers with a principal lifetime diagnosis of a depressive disorder, 1 had a comorbid lifetime depressive disorder, and 2 had comorbid lifetime diagnoses of anxiety, while 11 had no comorbid lifetime diagnoses.

2.2. Measures

2.2.1. Maternal diagnostic status

The Anxiety Disorders Interview Schedule for DSM-IV, Lifetime Version (ADIS-IV-L) (Brown, DiNardo, & Barlow, 1994) is a semi-structured interview that assesses current episodes of DSM-IV anxiety, mood and substance use disorders in addition to past (i.e. lifetime) episodes of these disorders. Clinical postgraduate students who had undergone specialised training in administering the ADIS-IV-L conducted the interviews in person or over the telephone. Mothers answered questions about present and past symptoms of various psychological disorders. If mothers endorsed enough symptoms, they rated the degree of interference caused by the symptoms for both current and past diagnoses using a 0 to 8 scale. Criteria for a disorder was met if a prescribed number of symptoms were endorsed and a clinician severity rating (CSR) of four or greater was assigned based on symptoms, distress and interference (Brown, DiNardo, Lehman, & Campbell, 2001). The ADIS-IV-L has sound psychometric properties (Brown et al., 2001). The diagnosis (past or current) with the highest CSR was considered the principal (i.e., most severe) diagnosis. All ADIS-IV-L diagnoses were reviewed in supervision and 20% were audiorecorded and coded by an independent rater for reliability purposes. Inter-rater reliability was excellent (principal diagnosis $k = .89$; second diagnosis $k = .82$).

2.2.2. Child diagnostic status

The Anxiety Disorders Interview Schedule for DSM-IV, Parent version (ADIS-C-IV) (Silverman & Albano, 1996) was used to assess the presence/absence of psychiatric disorders in children. Children had an anxiety disorder if they met DSM-IV criteria with a CSR of 4 or higher (scale 0–8), for at least their principal anxiety diagnosis.
(i.e. most severe). The ADIS-C-IV was administered over the telephone which is as reliable as face-to-face administration (Lynham & Rapee, 2005). Both versions have excellent psychometric properties (Silverman, Saavedra, & Pina, 2001; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). The ADIS-C-IV was administered by postgraduate clinical students trained by clinical psychologists experienced in anxiety assessment and all diagnoses were reviewed in supervision. Twenty percent of interviews were audiotapecoded and coded by an independent rater blind to children's diagnostic status. Inter-rater reliability showed excellent agreement for both the presence and absence of diagnoses (e.g., for principal diagnosis $k = .84$; for second diagnosis $k = 0.83$).

### 2.2.3. Maternal symptom measures

The Trait Scale of the State-Trait Anxiety Inventory (STAI Trait) (Spielberger, Gorsuch, & Lushene, 1970) is a 20 item self-report measure that mothers completed to assess their general level of anxiety. Items are assessed on a four point range from 1 (almost never) to 4 (almost always). The STAI has good psychometric properties (e.g., Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983; Spielberger, 1989).

The Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1995) was used to assess depression symptoms in mothers, and also provided additional measures of anxiety and tension/stress. It consists of 42 items to which respondents indicate the degree to which the statement applies to them over the past week using a 4-point scale ranging from 0 to 4 (did not apply to me at all) to 3 (applied to me very much, or most of the time). The DASS possesses sound psychometric properties (Lovibond & Lovibond, 1995). DASS Depression, Anxiety and Stress scores were positively skewed, so were log transformed before analyses.

#### 2.2.4. Child symptom measures

The Spence Children's Anxiety Scale, Parent version (SCAS-P) (Nauta et al., 2004) (39-item parent report measure) and Child version (SCAS-C) (Spence, 1998) (45-item child self-report measure; 6 positive filler items), were used to assess anxiety symptom severity. Both contain 4-point response scales (0 = never true to 3 = always true), yield total scores reflecting symptom severity, and possess sound psychometric properties. Mean SCAS-P total scores of 14.2 and 31.8, and mean SCAS-C total scores of 18.8 and 32.2 are reported for non-clinical and clinically-anxious children, respectively (Nauta et al., 2004; Spence, 1998).

The Centre for Epidemiologic Studies Depression Scale for Children (CES-DC) (Weissman et al., 2006) is a 20-item self-report measure of children’s depressive symptoms. Children respond on a four-point scale (0 = not at all to 3 = a lot) indicating how frequently the items have happened to them in the past week. Scores range from 0 to 60 with total score of 15 or higher considered to be clinically significant. The CES-DC has adequate reliability and validity (Faulstich, Carey, Ruggiero, Enyart, & Gresham, 1986).

#### 2.2.5. Attention bias

The visual-probe task was programmed using E-prime v1.1 (Psychology Software Tools, Inc) and presented on a Dell Optiplex computer with 17” 75 Hz CRT colour monitors housed in a University research laboratory. The stimuli, used in previous studies (Roy et al., 2008) were photographs of face-pairs from 64 different actors (half male, half female), each presenting a neutral and either an angry or happy expression. This resulted in 32 angry-neutral, 32 happy-neutral, and 16 neutral–neutral face-pairs used on filler trials.

Each trial began with a 500-ms fixation point followed by two faces presented side-by-side 500 ms. The face-pair was replaced with an asterisk (probe) for 1100 ms in the spatial location previously occupied by one of the faces. The emotional and neutral faces were presented equally often on the left and right side of the picture pairs, and the probe appeared equally often on the left and right side after each face pair. Participants pressed one of two keys labelled ‘left’ and ‘right’ as quickly as possible while avoiding mistakes, to indicate the location of the asterisk. The inter-trial interval varied randomly from 750 to 1250 ms. The task began with 10 random practice trials, followed by one block of 80 trials. On angry-neutral face pair trials, the probe appeared in the same spatial location as the angry face in half the trials (congruent trials), and on the opposite location to the angry face in the other half (incongruent trials). The same arrangement applied to trials with happy-neutral face-pairs. Trials from all face-pair conditions were intermixed in one block of 80 trials and a random order was generated for each participant.

### 2.3. Procedure

When mothers telephoned the research team in response to study advertisements, the initial exclusionary criteria were addressed and the participating mother was screened regarding her own current and past anxiety and depression and that of her participating child. The psychopathology of children was assessed next using the parent interview schedule of the ADIS-C-IV (Silverman & Albano, 1996) in either the same or a separate telephonic interview. If the child did not meet criteria for any psychiatric disorder, the mother was then assessed with the lifetime version of the ADIS (ADIS-IV-L) (Brown et al., 1994), either via the telephone ($n = 9$) or the University clinic ($n = 61$).

During a subsequent laboratory session, children completed the questionnaires with a research assistant who read aloud the items to account for children's reading variability while mothers completed the visual probe task in a separate room alone. Mothers then completed the questionnaires in a waiting room while the child completed the visual probe task.

### 2.4. Data preparation

RTs were excluded from trials with errors, and if RTs were $<200 ms$, $>1100 ms$, and then $>3$ SD above the participant’s mean RT. On average, RTs were missing from $7\%$ of trials for children, and $2\%$ of trials for mothers. Overall mean RT is $584 ms$ for children, and $481 ms$ for mothers. High- and low-risk children did not differ significantly in missing RT data, Mann–Whitney $U = 496.5, p = .49$, or overall mean RT, $t(65) = .10, p = .92$. Mothers with versus without lifetime emotional disorders also do not differ in missing data, Mann–Whitney $U = 456.5, p = .22$, or overall mean RT, $t(65) = 1.37, p = .18$. Consistent with previous studies (e.g., Roy et al., 2008; Salum et al., 2013), attention bias scores were calculated separately for angry-neutral and happy-neutral face pairs by subtracting the average RT on congruent trials (probe presented in the same location as the emotional face) from the average RT on incongruent trials (probe presented in the opposite spatial location as the emotional face i.e., in the spatial location of the neutral face). Positive values of the attention bias score reflect greater attention towards the emotional compared to the neutral face, and negative values indicate attention away from the emotional relative to neutral face.

### 3. Results

#### 3.1. Characteristics of high-and low-risk groups

High-risk ($n = 38$) and low-risk ($n = 29$) children did not differ significantly in age, $t(65) = .31, p = .76$, gender ratio, $X^2 = 0.14, p = .71$, SCAS-C, $t(65) = .31, p = .76$, SCAS-P, $t(65) = 0.57, p = .57$, or CES-DC total scores, $t(65) = 1.21, p = .23$ (see Table 1). Compared to
mothers, the high-risk group, negative attention bias in children was group between children's negative attention bias and mothers' relation was not signi (see Table 1).

$$r(65) = 3.01, p = .004,$$ and DASS-Depression scores, $$r(65) = 2.48, p = .016,$$ and trends for higher DASS-Anxiety, $$r(65) = 1.87, p = .066,$$ and DASS-Stress scores, $$r(65) = 1.87, p = .066.$$ They did not differ significantly in age, $$t(64) = .68, p = .50,$$ occupational prestige, $$t(63) = 1.76, p = .08,$$ negative attention bias, $$t(65) = .60, p = .55,$$ or positive attention bias, $$t(65) = .07, p = .95.$$

3.2. Children's attention biases

Contrary to hypothesis 1, high-risk and low-risk children did not differ significantly in negative attention bias, $$t(65) = .84, p = .40$$ (see Table 1).

To test hypothesis 2, correlations were calculated for each risk group between children's negative attention bias and mothers' positive and negative attention bias scores. Results showed that, in the high-risk group, negative attention bias in children was significantly correlated with reduced positive attention bias in mothers, $$r(36) = -.39, p = .015$$ (see Fig. 1, lower panel). This correlation was not significant in the low risk group, $$r(27) = .11, p = .56.$$

The difference between these correlations was significant, $$Z = 2.04, p = .04.$$ This relationship in the high risk group remained significant even when controlling for the effects of mothers' and children's anxiety and depression; i.e. partial correlation between child's negative bias and mother's positive bias was $$- .51, p = .003,$$ after controlling for children's anxiety (i.e., SCAS-C and SCAS-P total scores) and depression (i.e., CES-D total scores), and maternal anxiety and depression (i.e., STAI-trait anxiety, DASS-Depression, DASS-Anxiety and DASS-Stress scores). There were no other significant correlations between negative bias scores and symptom measures in either group ($- .29 < r < .19, p's > .1). Also, high- and low-risk children did not differ significantly in positive attention bias scores, $$t(65) = 1.26, p = .21,$$ and children's positive bias scores did not significantly correlate with symptom measures or mothers' bias scores in either group, or overall.

3.3. Stratification of high-risk group by maternal positive attention bias

To clarify the correlational results, high-risk children were divided into two groups depending on whether their mothers' positive attention bias scores were above or below zero ($0 = \text{no bias}$), resulting in three groups: (i) low-risk children (n = 29), (ii) high-risk children + mother with a positive bias (n = 20) and (iii) high-risk children + mother without a positive bias (n = 18). The three groups of children differed significantly in negative attention bias, $$F(2, 64) = 4.29, p = .018$$ (see Fig. 1, upper panel).

Contrasts of children's negative attention bias scores versus zero indicated a significant result: only high-risk children whose mothers lacked a positive attention bias showed a significant attention bias for negative information, one-sample $$t(17) = 3.16, p = .006.$$ The bias scores of the other groups were not significant (i.e., high-risk children + mother with a positive bias: one-sample $$t(19) = 1.67, p = .11;$$ low-risk children: one-sample $$t(28) = 1.00, p = .33).$$ Post hoc pairwise group comparisons with Bonferroni correction for multiple tests showed a significant difference in negative attention bias for high-risk children that was significant in maternal positive attention bias compared to high risk children without maternal positive bias, $$p = .02.$$ There were no significant group differences in children's positive attention bias scores, $$F(2, 64) = 1.24, p = .25,$$ or mothers' negative attention bias scores, $$F(2, 64) = .77, p = .47$$ (see Table 1 for descriptive statistics).

3.4. Supplementary analyses

Seventeen high-risk children had mothers with a past emotional disorder and 21 had mothers with a current diagnosis; 24 had mothers with a principal lifetime diagnosis of an anxiety disorder, and 14 had mothers with a principal lifetime diagnosis of a unipolar depressive disorder. There were no significant associations between these diagnostic categories and attention biases; e.g. type of principal lifetime disorder (anxiety versus depressive disorder) did

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Low risk (n = 29)</th>
<th>High risk (n = 38)</th>
<th>High risk + mother with positive bias (n = 20)</th>
<th>High risk + mother without positive bias (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Child Age (Y:M)</td>
<td>9.4</td>
<td>1.4</td>
<td>9.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Child SCAS-P total</td>
<td>11.7</td>
<td>8.0</td>
<td>11.4</td>
<td>6.1</td>
</tr>
<tr>
<td>Child SCAS-C total</td>
<td>25.1</td>
<td>14.8</td>
<td>23.2</td>
<td>13.1</td>
</tr>
<tr>
<td>Child CES-DC</td>
<td>13.2</td>
<td>9.3</td>
<td>10.9</td>
<td>6.1</td>
</tr>
<tr>
<td>Mother Age (Y:M)</td>
<td>42.1</td>
<td>4.3</td>
<td>41.2</td>
<td>5.3</td>
</tr>
<tr>
<td>Mother Occupation Prestige</td>
<td>4.0</td>
<td>1.2</td>
<td>4.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Mother STAI- Trait Anxiety*</td>
<td>30.5</td>
<td>7.1</td>
<td>37.7</td>
<td>11.3</td>
</tr>
<tr>
<td>Mother DASS- Depression*</td>
<td>0.8</td>
<td>1.6</td>
<td>3.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Mother DASS- Anxiety</td>
<td>1.0</td>
<td>2.9</td>
<td>2.4</td>
<td>5.3</td>
</tr>
<tr>
<td>Mother DASS-Stress</td>
<td>4.6</td>
<td>4.6</td>
<td>7.6</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>Attention bias (ms):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother Negative Bias</td>
<td>8.3</td>
<td>44.7</td>
<td>-1.3</td>
<td>47.2</td>
</tr>
<tr>
<td>Child Positive Bias</td>
<td>-1.0</td>
<td>42.6</td>
<td>13.9</td>
<td>52.0</td>
</tr>
<tr>
<td>Mother Negative Bias</td>
<td>9.2</td>
<td>30.1</td>
<td>5.3</td>
<td>23.1</td>
</tr>
<tr>
<td>Mother Positive Bias</td>
<td>1.2</td>
<td>22.5</td>
<td>1.5</td>
<td>18.0</td>
</tr>
</tbody>
</table>

Note. SCAS-P = Spence Children's Anxiety Scale, Parent version; SCAS-C = Spence Children's Anxiety Scale, Child version; CES-DC = Centre for Epidemiologic Studies Depression Scale for Children; STAI = State-Trait Anxiety Inventory; DASS = Depression, Anxiety and Stress Scale. DASS scores were log transformed before analyses to reduce skewness. Occupational prestige assessed with Daniel Prestige Scale (Daniel, 1983), range: 1 = high; 7 = low.

*Significant difference between low-risk and high-risk groups, p < .05.
4. Discussion

Despite a growing literature demonstrating that children of mothers with lifetime emotional disorders are at elevated risk for developing an emotional disorder, relatively little is known about the factors and mechanisms that underlie this elevated risk. The present study found no support for the first hypothesis that, as a group, offspring of mothers with a lifetime history of emotional disorders would display an attention bias for negative information. However, consistent with the second hypothesis, the present study found that, in the high-risk group, children displayed a significantly greater attention bias towards negative information if their mothers had a reduced attention bias for positive information. Bias scores were not associated with the timing of mothers’ diagnosis (current versus past) or their principal diagnostic category (anxiety versus depression). There were no significant group differences in children’s attention biases for positive stimuli.

Attention bias studies of high-risk offspring are sparse. A few studies provide mixed evidence of attention biases for emotional information in offspring of mothers with emotional disorders compared to low-risk offspring (e.g., Gibb et al., 2009; Joormann et al., 2007; Kujawa et al., 2011; Mogg et al., 2012). However, the direction of the bias in high-risk offspring has differed across studies, which may be due to methodological differences, including the use of mood induction procedures and differing stimulus exposure durations (e.g., Gibb et al., 2009; Joormann et al., 2007). However, previous studies have not examined attention biases in high-risk offspring as a function of combined maternal risk factors. Thus, the present findings extend previous research in suggesting that, in high-risk offspring, attention bias for negative information is a function of both mothers’ lifetime emotional disorders and attention biases. These findings are broadly consistent with developmental models proposing that risk to offspring, by virtue of maternal emotional disorders, may be transmitted through exposure to maternal cognitive biases (e.g., Goodman & Gotlib, 1999), which in this study was found to be the absence of a maternal positive bias. However, the present findings do not suggest a direct transmission of maternal attention biases to offspring, as there was no significant overall group difference in attention bias between high-risk children (of mothers with and without a positive attention bias) and low-risk offspring.

One explanation for the present results is that a lack of maternal positive bias increases offspring exposure to negative information. A lack of maternal attention bias to positive information may reduce offspring exposure to maternal displays of cognitive, emotional and behavioural responses to positive stimuli that their mothers avoid or ignore. This could increase offspring perceptions of their environment as being more negative.

Another explanation for the present results is that the presence versus absence of a positive bias in mothers with lifetime emotional disorders differentially influences the development of attention regulation strategies in offspring. It is possible that all high-risk children automatically direct their attention towards negative information, but this initial response is subsequently followed by attention redeployment in high-risk children whose mothers attend to positive information, but not in offspring of mothers who lack this bias. That is, high-risk offspring of mothers with a positive bias may have learned over time to rapidly redirect attention away from negative stimuli, and thus override the negative bias, in order to regulate mood. Such a strategy may then manifest as a reduced bias for negative information at 500 ms on the visual probe task. This attention regulation strategy could be acquired by various means, such as observation of their mothers’ regulation of attention in favour of positive information, maternal regulation of children’s attention allocation (e.g., encouraging children to direct attention away from negative and towards other stimuli), and the stimulus appraisals that mothers with a positive attention bias might provide their children once attention is redirected to other stimuli. By contrast, mothers with lifetime emotional disorders without a positive bias may lack or fail to utilise these attention regulation strategies, and thus, their high-risk offspring remain vigilant for negative information. Taken together, the presence of an attention bias for negative information in high-risk offspring of mothers without a positive bias could reflect a maladaptive attention monitoring strategy that arises through increased exposure to negative information and/or difficulty in overriding an intrinsic negative attention bias associated with maternal lifetime emotional disorder.

One of the main limitations of this study was that it was cross-sectional in nature, and therefore unable to assess long-term
predictive effects. Also, mothers with emotional disorders were a highly heterogeneous group diagnostically and sample sizes were relatively small. This may have contributed to the lack of significant differences in attention biases between mothers with and without lifetime emotional disorders. Relatively small sample sizes may also have contributed to other non-significant results (e.g., mean negative bias scores of the low risk group was intermediary between, and not significantly different from, those of the two high risk subgroups). Although maternal emotional disorders assign significant risk for psychopathology in offspring (e.g., Goodman & Gotlib, 1999; Rapee, Schniering, & Hudson, 2009), future research should also examine the effects of paternal emotional disorders and attention biases on offspring attention biases and symptoms over time. The present study included just one exposure duration of 500 ms. It may be useful in future studies to include shorter and longer exposure durations (e.g., 200–1500 ms), which may help clarify whether some high-risk children (e.g., those whose mothers have a positive bias) initially orient to negative stimuli and then rapidly redirect attention away from such stimuli. Furthermore, as evidence of disorder-specificity effects in attention biases is mixed in relation to anxiety and depression, possibly due to high rates of comorbidity (Shechmer et al., 2012), future research should include a wider range of negative stimuli to explore these potential effects.

In summary, this study indicates that offspring of mothers with lifetime emotional disorders who lacked an attention bias to positive stimuli showed a greater attention bias towards negative information than high-risk offspring of mothers who displayed a positive attention bias. These findings may be due to greater exposure to negative information and/or deficits in attention regulation strategies in high-risk offspring of mothers without a positive bias. Longitudinal research will determine the extent to which maternal emotional disorders and attention biases contribute to symptom development in offspring.

Acknowledgements

This research was supported by Australian Research Council Grant DP1505536 awarded to Dr Allison Waters.

References


