The role of rumination in the relationship between postnatal depressive symptoms and maternal attunement

Submitted by Michelle Caroline Tester-Jones to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Psychology In September 2014

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Signature: ……………………………………………………………………………..
Acknowledgments

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Abstract

The aim of this thesis was to increase understanding of how rumination, defined as the behaviours and thoughts that focus an individual’s attention on their depressive symptoms and on the implications of these symptoms (Nolen-Hoeksema, 1991), affects the relationship between postnatal depressive symptoms and maternal sensitivity. Study 1 examined the impact of self-reported maternal rumination on perceived maternal attunement and mood, and the role of perceived social support and infant temperament in this relationship in a community sample of mothers ($N = 203$). Rumination mediated the relationship between maternal depressive symptoms and maternal responsiveness when infant negative affect was low but not high. Contrary to predictions, rumination did not mediate the relationship between social support and maternal attunement. Study 2 incorporated a second assessment point approximately six months later with the same sample. Prospective analyses were undertaken to examine the directional relationship between rumination and maternal attunement in the context of depressive symptoms. Unexpectedly, analyses revealed that maternal bonding prospectively predicted rumination at six months, after controlling for rumination at baseline. The converse relationship was not significant. This was contrary to the thesis hypothesis that increased rumination would predict impaired attunement at six months. Partially consistent with the thesis hypotheses, the relationship between rumination and maternal attunement was moderated by depressive symptoms at baseline; such that mothers who were low in depressive symptoms and had lower bonding at baseline reported higher levels of rumination at 6 months. Study 3 also explored the directional relationships between maternal mood, rumination and maternal attunement at a state level in a daily diary study with a community sample of mothers ($N = 94$) with infants aged between 3 and 14 months. Consistent with the findings of study 2, state maternal bonding at Time 1 predicted both state maternal rumination and state maternal mood at Time 2, and state
rumination at Time 2 mediated the relationship between state bonding at Time 1 and state mood at Time 2. In the final study, the causal relationships between an experimentally induced state of ruminative thinking and observed maternal behaviours in a mother-infant interaction task were examined in a sample of dysphoric and non-dysphoric mothers (N = 79) and their infants. The analyses examined change in mother-infant interaction quality from baseline to post rumination induction, and subsequent change following an infant stressor task. Findings revealed a significant reduction in maternal sensitivity and mother-infant dyadic synchrony in the rumination group, but not the control group. For maternal sensitivity, the effect of rumination was exacerbated following the stressor task. Contrary to predictions, this relationship was not moderated by dysphoric symptoms. The findings of this thesis indicate that ruminative thinking directly impairs observed maternal behaviours, but that perceived poorer maternal attunement also increases self-reported ruminative thinking. The significance of these findings for theoretical explanations of rumination in a postnatal context are considered, and the clinical implications for parenting programmes and interventions for both mothers in the community as well as those considered at risk are discussed.
Statement of contribution to co-authored papers

Each of the studies included in this thesis have been written up as manuscripts that have either been submitted for publication, or are being prepared for submission. Each paper is at various stages in the preparation and review process and the status of each paper is summarised below. Each chapter includes a preface at the beginning which provides a discussion of how each manuscript contributes to the aims and hypotheses of the overall thesis. Each preface also includes details that have been omitted from the manuscript in order to comply with the corresponding journal’s word count, but are important in aiding the coherence of the overall thesis. Similarly, individual chapter appendices also include supplementary analyses that were not reported in the manuscript. In all cases the candidate is responsible for the work in this thesis; however, the declaration below outlines the input of a number of co-authors in preparation of the manuscripts, in order to accurately reflect and acknowledge contributions to each paper.

Declaration by candidate:

Paper 1, Chapter 3:
The manuscript presented in Chapter 3 has been written up and submitted for review to Infant Behaviour and Development. Contributions of the candidate and all co-authors are as follows:
The candidate contributed to the design of the project, the writing of the manuscript, and conducted all data collection, analysis and interpretation.
Dr Heather O’ Mahen contributed to the design of the project, data analysis and supervisory support in the review and editing of the manuscript.
Professor Edward Watkins participated in the preparation of the article through critical review of several iterations of the writing process.

Dr Anke Karl participated in the preparation of the article through critical review of several iterations of the writing process.

Paper 2, Chapter 4:
The manuscript presented in Chapter 4 is currently being prepared for submission to the British Journal of Psychiatry. Contributions of the candidate and all co-authors to date are as follows:
The candidate contributed to the design of the project, the writing of the manuscript, and conducted all data collection and analysis and interpretation.
Dr Heather O’ Mahen contributed to the design of the project, data analysis and supervisory support in the review and editing of the manuscript.

Paper 3, Chapter 5:
The manuscript presented in Chapter 5 is currently being prepared for submission to the Journal of Abnormal Psychology. Contributions of the candidate and all co-authors are as follows:
The candidate contributed to the design of the project and the writing of the manuscript, and conducted data collection, analysis and interpretation.
Dr Heather O’ Mahen contributed to the design of the project, data analysis and interpretation and supervisory support in the writing of the manuscript.
Dr Nick Moberly contributed to the design of the project, provided advice and support in statistical analysis and guidance and support in writing the methods and results section of the manuscript.
Dr Anke Karl participated in the preparation of the article through critical review of several iterations of the writing process.

Paper 4, Chapter 6:
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The candidate contributed to the design of the project, the writing of the manuscript, and conducted data collection, analysis and interpretation.
Dr Heather O’Mahen contributed to the design of the project, data analysis and supervisory support in the review and editing of the manuscript.
Professor Edward Watkins participated in the preparation of the article through critical review of several iterations of the writing process.
Dr Anke Karl participated in the preparation of the article through critical review of several iterations of the writing process.

Candidate signature:

Declaration by supervisor:
I, Dr. Heather O’Mahen, confirm that the above statement reflects the nature and extent of the candidate’s contributions to the work, and that the candidate’s declaration of contributions made to the research by me, by other members of the supervisory team, and by other members of staff of the University is accurate.
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CHAPTER 1: Introduction

This thesis will explore how rumination contributes to the relationships between depressive symptoms, maternal attunement and child outcomes. There is a clearly established association within the literature between postnatal depression (PND) and child outcomes (Sohr-Preston & Scaramella, 2006), and a substantial body of findings to suggest maternal sensitivity, defined as the quality with which a mother responds to her infant’s cue in a timely and appropriate manner (Leerkes, Blankson, & O’Brien 2009) is a mechanism mediating this relationship (see Feldman et al, 2009; Campbell, Matevic, von Stauffenberg, Mohan & Kirchner, 2007). It is well recognised that early mother-infant interaction has a significant bearing on the long lasting negative impact on children of mothers who have experienced maternal PND (Stein et al., 1991) and many studies indicate that maternal attunement plays a role in this relationship. However, less is known about the relationship between PND and maternal attunement, and the possible processes that may be affecting this relationship. Maternal cognitive factors that are present in depression and may affect maternal sensitivity have been relatively neglected in the literature. In this thesis I propose that that rumination, defined as the behaviours and thoughts that focus an individual’s attention on their depressive symptoms and on the implications of these symptoms (Nolen-Hoeksema, 1991), may be an important mechanism linking postnatal depression and maternal sensitivity.

1.1 Thesis outline and objectives

The aim of the current thesis is to increase understanding of the relationship between postnatal depressive symptoms and maternal sensitivity, and the role rumination has within this relationship. The thesis is structured as follows: Chapter 2 provides an overview of postnatal depressive symptomatology and prevalence followed
by a discussion of theory and empirical evidence pertaining to a) maternal sensitivity and child outcomes; b) rumination and c) evidence which indicates rumination may play a key role in the relationship between postnatal depression and maternal sensitivity.

Analyses are then reported from three samples: a community sample mothers with infants aged nine to 14 months old ($N = 203$, chapters 3 and 4); a community sample of mothers ($N = 94$) with infants aged between 3 and 14 months old (chapter 5) and dysphoric and non-dysphoric mothers with infants aged between three and 12 months old ($N = 79$, chapter 6).

Chapter 3 (study 1) extends previous cross sectional findings and explores the concurrent relationships between maternal depressive symptoms, rumination, maternal attunement and infant temperament. Chapter 4 (study 2) assesses the prospective relationship between maternal depressive symptoms rumination and perceived maternal attunement, with the aim of assessing whether rumination predicts impairments in maternal attunement at a six month follow up in mothers with depressive symptoms. Chapter 5 (study 3) builds on the results from chapter 4, examining the temporal, prospective relationships between rumination, self-reported maternal attunement and mood at a state level using a daily diary methodology. Chapter 6 (study 4) examines the causal role of an experimentally induced ruminative thinking style in impairments to maternal sensitive behaviours towards her infant using an objective observational assessment of maternal attunement. This chapter also provides a preliminary investigation into the impact of rumination on attentional engagement with infant distress. The thesis concludes with a general discussion and appendix 1 also assesses rumination as an emotion regulation technique in a sample of 68 undergraduate students and examines whether high trait rumination is associated with a more severe decrease in mood that lasts longer in duration in response to a negative stimuli, compared to low trait rumination.
CHAPTER 2: Literature review

The following review has four main sections: Section 2.1 provides a summary of postnatal depressive symptomatology and prevalence; Section 2.2 explores literature examining the relationships between postnatal depression, maternal attunement and child outcomes; Section 2.3 gives an overview of theory and empirical evidence which informs our current understanding of rumination; Section 2.4 reviews current empirical evidence which suggests that rumination may be a process that affects key parenting mechanisms and consequently the relationship between postnatal depressive symptoms and maternal attunement.

2.1 Postnatal depression: symptomatology and prevalence

Major depression is a common, recurrent and debilitating disorder which, for many, is considered a lifelong and chronic illness (Richards, 2011). Diagnosis is primarily based on the presence of depressed mood or loss of interest or pleasure with other symptoms including poor appetite, insomnia, low energy, poor self-esteem, lack of concentration and feelings of hopelessness (DSM IV; American Psychiatric Association [APA], 2000). The World Health Organisation (WHO) estimates that by 2020, depression will be the second leading cause of disability worldwide (Murray & Lopez, 1996). Epidemiological studies have demonstrated that depression is highly prevalent; the National Comorbidity Survey (NCS) reports a 12 month prevalence of 8.6% and a lifetime prevalence of 14.9% (Kessler et al., 2003).

Postnatal (or postpartum) depression is a term applied to depression that occurs during the postnatal period, which is viewed as up to 1 year after childbirth in research and clinical practice (O’Hara, 2009). The DSM-IV-TR more narrowly defines postnatal depression as depression that has an onset within the first 6 weeks following the birth of
the infant(s), and the DSM-V specifies peri-partum onset, occurring either in pregnancy or the first four weeks following birth. Examples of symptoms include sad mood, loss of interest, difficulty concentrating and low energy. It is noted that additional symptoms commonly observed include mood fluctuations and over concern with the infant (APA), often accompanied by co morbid anxiety symptoms or disorders (O’Hara, 2009). It is important to differentiate between postnatal depression and postnatal blues (baby blues), which refers to mood symptoms that are common in the first week to 10 days after delivery that usually diminish within a few days without any intervention (O’Hara & Segre, 2008).

Like Major Depressive Disorder, postnatal depression (PND) is recognised as a significant health issue for many women, with studies identifying prevalence rates of 6.5% to 12.9% in the first year postpartum (Gaynes et al., 2005). When minor depression is included, the prevalence rate in the first three months postpartum rises to 19.1% (Gavin et al, 2005). Longitudinal patterns of depression from 18 weeks gestation to 8 months postpartum show stability of depression to be moderate (Heron, O’Connor, Evans, Golding & Glover, 2004) and studies suggest that postnatal depression remains a long term problem for 30 to 50 percent of women. A critical review revealed that in all follow up studies, scores for depressive symptoms decrease over time. However, these scores did not always fall below recommended cut offs, with 30% of community samples remaining depressed three years postnatally and 50% of clinical samples remaining depressed throughout and beyond the first postpartum year (Vliegen, Casalin & Luyten, 2014). Importantly, PND has a negative association with child outcomes, rendering depression particularly disabling during their life period.
2.2 Postnatal depressive symptoms and child outcomes

Research examining PND has demonstrated the debilitating and difficult impact of the disorder for the mother, the family and particularly the new born infant. Postnatal depression is associated with negative outcomes in infants and young children at least partly through impaired mother-infant interactions and negative perceptions of infant behaviour (Dennis, 2005). A number of studies have established the consequences of postnatal depressive symptoms in key areas of infant and child development.

2.2.1 Cognitive development

It is well established in the literature that PND has a significant longitudinal relationship with infant cognitive development in areas such as language, intelligence (IQ), and object concept tasks that persists beyond PND and the first postnatal year (for a review see Grace et al., 2003). Infants have been found to be less responsive to faces and voices as early as the neonatal period. During this period infants have also shown less orienting to face and voice stimuli and to their own and other infants’ cry sounds (Hernandez-Reif, Field, Diego & Ruddock, 2006) as well as infant delayed heart rate decelerations to instrumental and vocal music sounds, attributed to delayed attention and slower processing. Stanley, Murray & Stein (2004) have also demonstrated that more negative mother-infant face to face interactions were predictive of poorer infant instrumental learning at 18 months and more recently, maternal depressive symptomatology in the postnatal year, but not at 36 months, was found to be associated with poorer child language at 36 months (Stein, Malmberg, Sylva, Barnes, & Leach, 2008).

2.2.2 Behavioural and social outcomes
Short term prospective studies have shown that PND accounts for adverse infant behaviour including heightened negative emotionality and low positive emotionality. Mothers’ reports of infant temperament have been found to be significantly different for depressed compared to well mothers, with depressed mothers reporting more difficult and unsettled infant behaviour in the first six months postpartum (McGrath, Records & Rice, 2008; McMahon, Barnett, Kowalenko, Tennant & Don., 2001). Infants of postnatally depressed mothers were also found to be more insecurely attached to their mothers and demonstrated more mild behavioural difficulties when compared to infants of a well control group in a follow up assessment at 18 months old (Murray, 1992). A meta-analysis also found a moderate to large adverse effect on infant emotional behaviour in the first year postpartum (Beck, 1995).

Longitudinal data (Murray, 1992) have also demonstrated that PND is associated with longer term negative child outcomes both in terms of behavioural and social adjustment in school at age five (Sinclair & Murray, 1998; Murray et al., 1999) and in peer play (Hipwell, Murray, Ducournau & Stein, 2010). Other recent studies using Murray’s data also demonstrate that PND has negative long term effects on boys’ academic performance at age 16 (Murray et al., 2010) and girls’ emotional sensitivity at age 13 (Murray, Halligan, Adams, Patterson & Goodyer, 2006) even after controlling for later exposure to maternal depression.

Similarly, data from the Avon Longitudinal Study of Parents and Children (ALSPAC) has found that PND predicted a small increase in externalizing difficulties, a small decrease in verbal IQ, and a small increase in internalizing difficulties in the child at ages seven to eight when controlling for prenatal depression and other risk factors (Barker, Jaffee, Uher, & Maughan, 2011). Furthermore, longitudinal data from National Institute of Child Health and Human Development (NICHD, 1999) has found that children whose mothers reported feeling depressed performed more poorly on measures
of cognitive-linguistic functioning and were rated as less cooperative and more problematic at three years.

A meta-analysis of nine studies (Beck, 1998) provides further longitudinal support for the relationship between PND and child emotional outcomes, revealing a small but significant adverse effect of PND on distractibility, antisocial and neurotic behaviour in the home and at school in children between the ages of one and 14 years. It is noteworthy that in this meta-analysis, less than half ($N = 4$) of the studies included controlled for current maternal depression. A sub meta-analysis revealed a slightly smaller effect size of PND on child outcomes when the study controlled for current maternal depression versus those that did not control for current maternal depression.

Overall, findings from longitudinal data demonstrate that PND predicts an increase in both internalising and externalising behaviours, poorer academic performance (and in particular poorer verbal and linguistic functioning) and less cooperative social behaviour. However, with low rates of ethnic minorities in the ALSPAC database and the majority (60%) of participants being classified as middle or upper class in Murray’s (1992) database, it is important to be aware of the limitations of less representative samples with respect to diversity and socioeconomic status when drawing conclusions.

2.2.3 Emotion regulation

A number of studies have demonstrated that PND has an adverse effect on children’s ability to control, regulate and manage their emotions. The ability to regulate emotion effectively plays a vital role in the development of many competencies in childhood, including developing peer relationships, social competence and social and emotional well-being (Sroufe, 1997). Children who are unable to maintain emotional control when presented with difficult social situations (e.g. anger, aggression) are more
likely to suffer from peer rejection, social isolation and poor social self-perception (Maughan, Cicchetti, Toth & Rogosch, 2006).

Short term prospective studies have demonstrated that emotion regulation is implicated in an infant’s ability to use attention efficiently, ultimately interfering with the successful deployment of attentional resources and therefore successful cognitive development (e.g. Weinberg & Tronick, 1998). Longitudinal studies have also found that early occurring maternal depression (depression occurring during the first 21 months of the child’s life) has been found to predict children’s dysregulated emotion patterns at age four. Dysregulated emotion patterns also mediated the relationship between maternal depression and child ratings of perceived social acceptance (Maughan et al, 2006). Hay (1997) proposed that this could result from two particular features of a depressed mother’s relationship with her baby: (1) a lack of contingency and synchronicity between the infant’s actions and the mother's responses and (2) high distress levels on the part of both infant and mother.

2.2.4 Postnatal depressive symptoms, maternal attunement and child outcomes

These studies demonstrate the prevalence of negative outcomes both during and beyond the first few years of the infant’s life. It has therefore become critically important to identify factors that impact this risk. It is well recognised that the quality of early mother-infant interactions have a significant negative impact on children of mothers who have experienced maternal PND (Stein et al., 1991) and the findings of numerous studies indicate that maternal attunement is implicated in both child outcomes and PND independently, and may be a key factor in the relationship between the two.

Maternal attunement can be viewed as a multidimensional construct. Markova and Legerstee (2006) define attunement as responsiveness and warm sensitivity. This encompasses promptness, appropriateness of reactions and responsiveness to infant
signals and behaviours. According to Meins (1999), a crucial aspect of maternal sensitivity is that the mother’s responses firstly be prompt, but also are appropriate to the infant’s cues. This implies a necessity for recognition and interpretation on the part of the mother. Maternal sensitivity could therefore be described as an amalgamation of both abilities and actions performed by the mother. Thus, a sensitive mother is able to perceive her infant’s cues and interpret them correctly. This requires effective monitoring of the infant’s state and recognition that infants have their own desires, thoughts, and intentions, before responding to them appropriately.

Attunement between mother and child can also be considered as directly affected by the maternal-infant bond (Mead, 2004; Klaus & Kennell, 1976), which can be defined as the thoughts, feelings and behaviours that are directed to maintain the mother’s physical and psychological proximity to the child (Feldman, Weller, Leckman, Kuint & Eidelman., 1999). Conversely, maternal responsiveness includes appropriate maternal behaviours that are prompt, contingent, identifiable, and are carried out in direct response to cues given by the infant (Amankwaa, Pickler & Boonmee, 2007). These definitions tap into different attributes of the mother infant relationship. Thus, in this thesis attunement was operationalised using a variety of different measures including assessments of bonding, responsiveness and sensitivity in order to explore these different attributes. The term attunement is used as an umbrella term, acknowledging the multifaceted nature of the construct.

Bigelow et al. (2010) found that appropriate attunement was positively related to secure infant attachment (Wolff & Van IJzendoorn, 1997; Meins, 1997; Van Den Boom, 1994), language acquisition (Tamis-LeMonda & Bornstein, 2002), and maturity of object play (Bigelow, MacLean & Proctor, 2004). However, disruptions in maternal sensitivity are related to both immediate and long term negative infant outcomes.
Research has shown an association between decreased maternal sensitivity and negative infant temperament as assessed via levels of positive, negative and motor reactivity (arm and leg movement, back arching) to novel auditory and visual stimuli (Calkins, Fox & Marshall, 1996; Fox, Henderson, Rubin, Calkins & Schmidt, 2001). Ghera, Hane, Malesa & Fox (2006) also assessed maternal perceptions of infant soothability at nine months using the soothability subscale of the Infant Behaviour Questionnaire. They found a significant relationship between observed infant temperament and maternal attunement during feeding and free play tasks. Moreover, this relationship was positive for infants who were perceived to be highly soothable by their mothers and negative for infants who were perceived by their mothers to be unsoothable.

Longitudinal data (NICHD, 1999) have also demonstrated that insecurely attached children (assessed at 15 months) who subsequently experienced low-sensitive mothering (assessed at 24 months) exhibited more problem behaviours, lower social competence and poorer language skills and school readiness at age three (Belsky & Fearon, 2002). Early experience of insensitive mother-infant interactions has also been found to predict the persistence of poorer cognitive functioning at age five (Murray, 1992; Murray, Fiori-Cowley, Hooper, & Cooper, 1996).

As well as its clearly established relationship with child outcomes, a number of aspects of early maternal sensitivity and responsiveness are also independently associated with maternal depressive symptoms. For example, depressed mothers have been found to be more irritable, less engaged and show less emotion and warmth to infant in the first three months postpartum (Lovejoy, Graczyk, O'Hare & Neuman, 2000) compared to a non-depressed sample. Mothers with depression have also demonstrated less sensitive attunement to infant (Murray et al., 1996), more negative
speech patterns and more restraining behaviours (Herrera, Reissland & Shepherd, 2004).

Cooper et al. (1999) found that mothers with PND exhibited poorer engagement with their infant, with the infant in turn demonstrating less active engagement and attentiveness to their mother as shown during an observational play task. More recently, Stanley et al. (2004) found that mothers with PND were less sensitively attuned (assessed through the mothers ability to empathise with her infant, mirror her infants behaviours and respond to and greet her infant when they reengaged with their mother) to their infants at 2 months, as compared to healthy controls. Mothers with PND also showed lower rates of positive contingent responsiveness to their infants, and higher rates of negative responsiveness including hostile or critical rejection of their infants’ behaviours or emotional state, substitution of infant affect (e.g. laughing when the infant cries) and exaggeration of infant behaviour to an excessive degree.

Given that these relationships are well established in the literature, a number of studies investigating disruption to maternal sensitivity and its impact on infant outcomes have done so in the context of PND. For example, early disturbances of mother–infant interaction at six months mediated subsequent cognitive deficits in children of depressed mothers on the Wechsler Preschool Primary Scale of Intelligence (Revised) at 42 months of age (Milgrom, Westley & Gemmill, 2004). In another study mother-infant relationship quality also mediated the relationship between maternal depressive symptoms and disruptive behaviour disordered outcomes for the child measured one year later (McCarty & McMahon, 2003).

Campbell et al. (2004) also examined PND and maternal sensitivity as predictors of infant attachment security between the ages of six and 36 months, assessing PND at one, six, 15, 24, and 36 months. The relationship between maternal
depressive symptoms and infant attachment style was moderated by maternal sensitivity. Women with intermittent, chronic or late (did not report depressive symptoms until the 24 and/or 36-month assessment), symptoms of PND who were also low in sensitivity were more likely to have toddlers who were insecure, in contrast to symptomatic women who were high in sensitivity.

However, it is noteworthy that maternal sensitivity is not consistently found to mediate the relationship between maternal depressive symptoms and child outcomes. Campbell et al. (2007) found that both maternal sensitivity and depressive symptoms were associated with cognitive functioning and social competence at age seven, but maternal sensitivity did not mediate the relationship between depressive symptoms and child outcome measures, suggesting that both maternal sensitivity and maternal depression group status were independently associated with these two child outcomes in this study. Further, in this study maternal sensitivity was not found to be predictive of child internalising or externalising behaviours after controlling for depressive symptoms, suggesting that maternal sensitivity may be associated with some child outcomes but not others.

### 2.2.5 Maternal sensitivity and maternal behaviours in the context of depressive symptoms

Mother-infant interaction studies demonstrate how numerous aspects of maternal sensitive behaviour are disrupted in the context of PND. Depressed mothers can be further subtyped into at least two groups: 1) those who display controlling, intrusive and angry behaviours and 2) those who demonstrate disengaged, unresponsive and withdrawn behaviours (Malphurs, Raag, Field, Pickens & Pelaez-Nogueras, 1996). Other research has shown that depressed mothers exhibit more rough behaviours (e.g. rough pulling and poking) when interacting with their infant (Fergus, Schmidt, & Pickens, 1998), greater negative affect in their vocal tone (Herrera et al., 2004), and
touch their infants in a less affectionate manner (Ferber et al., 2008) compared to non-depressed mothers.

Maternal sensitivity has also been implicated in the mother’s ability to discriminate between patterns of infant cry features (Donovan, Leavitt, & Walsh, 1998). Donovan and colleagues (1998) explored sensitivity at a sensory level and suggested that signal processing (sensitivity) reflects how well an individual is able to make correct judgments and avoid incorrect ones. A signal detection task was used in which mothers of four to six month old infants were asked to try and detect differences between an initial standard cry and different variants of that cry. The frequency of the standard cry was either altered by varying increments to produce a different cry or left the same. Mothers were asked to identify whether the second cry was the same or different to the first and how confident they were of their decision. Response times to make a decision were measured. Maternal depression as well as conflict and marital happiness predicted sensitivity (the mother’s ability to discriminate small differences in cries varying in frequency). These findings suggest that a mother suffering from PND may also have a reduced capacity for processing her infant’s signals (for example, recognising her infant’s different emotions). Donovan et al. (1998) argued that this may affect her ability to learn, adapt and change in response to her developing baby’s needs.

These studies serve to demonstrate that both observed and vocal cues can be neglected when sensitivity is decreased in the mother and this has been shown to predict negative infant outcomes. It is noteworthy that in these studies maternal sensitivity is largely determined using observation of the mother’s behavioural affect when interacting with her infant (i.e. how the mother responds to her infant’s needs and cues). With their work on maternal signal processing, Donovan and Colleagues (1998) highlight a gap in current research. They demonstrate that how a mother responds to her infant can not only be determined by the response (decision making) system, but also
assessed at different levels (e.g., sensory) and using different methods focusing on recognition of the infant’s needs and cues. This poses a question around what other methods may be employed to assess maternal attunement. It is possible that there are other maternal processes and mechanisms that may be assessed in order to determine a mother’s ability to perceive her infant’s cues and interpret them correctly.

Miens’ (1999) definition of maternal sensitivity encompasses the need for effective recognition of infant cues and appropriate interpretation of, and response to infant needs. It is therefore suggested that broad research questions aimed at assessing maternal attunement should also look towards assessing and examining each of these components; recognition, interpretation and response. This review will consider the mechanisms by which a mother’s abilities and actions that constitute her maternal attunement may be affected, and the potential consequences of this.

2.2.6 Maternal attunement and rumination

Less is known about the mechanisms underlying the proposed link between PND and maternal attunement, and this may be a crucial area to better understand because whilst there is a good understanding of the impact of PND on maternal sensitivity, we do not yet understand why or how PND affects maternal attunement, or whether there are specific components of attunement that PND affects (e.g. bonding, sensitivity). Whilst much research has focused on mechanisms including maternal behaviour and genetics, there has been little attention to the role of maternal cognitions in the area of PND and maternal attunement. However, in a recent review of the literature Stein, Lehtonen, Harvey, Nicol-Harper & Craske (2008) used the term ‘preoccupation’, which they defined as “as a state of narrowed or self-focused attention in which one’s mind is dominated by recurrent negative intrusive thoughts that are difficult to control, difficult to dismiss and recur even if dismissed” (p12). They argued
that one type of preoccupation is rumination and that this may be one of the cognitive processes that could affect the mother-infant relationship.

Rumination is a widely studied cognitive process in depression (Smith & Alloy, 2009). There is robust prospective and experimental evidence linking rumination to the onset and persistence of depressed mood, and as such is an important consideration in the context of PND. There are a number of conceptualisations of rumination. Nolen-Hoeksema (1991) defined rumination as passively and repetitively focusing on one's symptoms of depression and the possible causes and consequences of these symptoms. In contrast, Carver & Scheier (1981) conceptualise rumination as a perceived discrepancy between a current state and a desired state and Martin & Tesser (1996) define rumination as “a class of conscious thoughts that revolve around a common instrumental theme and that recur in the absence of immediate environmental demands requiring the thoughts”.

There is evidence that rumination serves to prolong depressive mood states and emerging research suggests it serves a passive, versus active, coping style. In prospective studies, rumination has been associated with the onset and maintenance of generally depressive mood (e.g. Nolen-Hoeksema, Larson & Grayson, 1999; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, 2000). As such, it is possible that rumination may interfere with aspects of mental functioning that are key mechanisms for a parent, particularly attention and responsivity to the environment. This review will therefore consider the evidence for rumination as a key cognitive process in maternal postnatal depression, parenting and child outcomes.
2.3 Rumination and depression

A number of models and definitions of rumination have been presented within the literature, a prominent one being Nolen-Hoeksema’s (1991) Response Styles Theory. According to Nolen-Hoeksema, Wisco and Lyubomirsky (2008) rumination is a mode of responding in which the individual engages in passive, repetitive focusing on symptoms and consequences of their distress, without engaging in active problem solving to address their difficulties. The Response Styles Theory proposes that whilst many people are likely to ruminate at one time or another, there are a subset of individuals who tend to more often respond to feelings of depression or distress with rumination and can therefore be described as having a ruminative response style.

A related model of rumination is the Rumination on Sadness conceptualisation (Conway, Csank, Holm & Blake, 2000), which also defines rumination as repetitive thinking but specifies the model as one of sadness and the circumstances that may be related to an individual’s sadness. Whilst this model holds a similar definition of rumination to that of Nolen-Hoeksema, it is not widely used and as such it is not possible to fully understand the applications of the model in terms of its usefulness in predicting depression or other psychopathology as a direct response to sadness (Smith & Alloy, 2009). Similarly, the Stress Reactive model (Alloy et al, 2000) suggests that rumination revolves around negative, event related inferences. However, the model limits its definition to the context of the experience of stressful events, and as such may fail to take into account other potentially important ruminative themes, such as memories or self-critiquing thoughts that are unrelated to the stressor. Whilst these latter theories of rumination are not as widely adopted, they do present the argument that rumination can be related to a number of different affective states, rather than depressed mood alone. Indeed, more recently RST has expanded the definition of rumination to
include passive and repetitive responding to distress, rather than depressive symptoms alone, in order to reflect that rumination has been implicated in a number of disorders as well as depression (Nolen-Hoeksema et al. 2008).

In contrast, the Goal Progress Theory (Martin, Tesser & McIntosh, 1993) conceptualises rumination as repetitive thinking about goal discrepancy. Here, rumination is defined not as a reaction to mood per se, but instead a response to failure to reach a goal. Goal theory proposes a hydraulic, comparator model of both mood and rumination. Individuals theoretically monitor their progress towards their goal(s). Both the size of the discrepancy between feedback about their current state and the goal and the rate of speed with which they are reaching their goal are hypothesized to result in mood valence and amount of rumination. Large discrepancies and slower than desired progress towards the goal are proposed to result in both sad mood and repetitive thinking about the discrepancy and lack of appropriate progress. This self-regulatory theory proposes that rumination may serve a beneficial purpose to the extent that it helps individuals to appropriately focus on and resolve discrepancies. Dysfunctional rumination is hypothesized to occur when goals are linked to core, higher-level outcomes (Martin, & Tesser, 1996; Watkins, 2004) without also considering the goal at lower levels that may facilitate problem-solving and active behaviours. For example, an individual who has a goal around being a good mother may feel negatively if her baby has difficulties with feeding and is also late with a developmental milestone. If she focuses on the discrepancy at a higher level, she may ruminate about the wellbeing of her child and of her abilities as a parent. Focusing instead at a lower level, she might problem-solve and seek advice and support around both feeding strategies and individual variation on development.

This conceptualisation of rumination may be considered broader than Nolen-Hoeksema’s, and it simultaneously allows for the notion of rumination as a function of
depressed mood. As such it is worth considering how the two theories fit with one another. It is possible to observe RST and Goal Progress Theory as more interrelated (Figure 2.1) than separate. In the model below, RST can be seen as a secondary process that occurs as a result of repetitive thinking about goal discrepancy.

Figure 2.1:
Response Styles Theory as a secondary process and subsumed within Goal Theory

The Goal Progress model may be relevant in the postnatal period given that it taps several aspects of rumination including cognition, meta-cognitions about rumination itself and motivation; all of which may have an important impact in the context of maternal attunement. Overall, these conceptualisations of rumination extend our understanding and are in many ways interlinked with one another. In this thesis a Response Styles Theory framework will be adopted, also taking into consideration how the Goal Progress Theory may be relevant in the postnatal period.

2.3.1 How is rumination linked to depression?

There is considerable correlational and experimental evidence linking rumination and depressed mood. Studies of naturally-occurring dysphoria, due to stress or traumatic life events, have shown that people who routinely ruminate in response to their negative moods report longer and more severe periods of dysphoria than those who manage their mood with pleasant, distracting activities (also see Nolen-Hoeksema et al., 1999; Nolen-Hoeksema & Morrow, 1991; Roberts, Gilboa, & Gotlib, 1998). Kuehner & Weber (1999) examined the relationship between rumination and depression in a clinical sample, assessing a cohort of 52 unipolar depressed in-patients using the
Response Styles Questionnaire (Nolen-Hoeksema, 1991). This was administered during an in-patient stay, four weeks after discharge and again at four months after discharge. Both trait rumination and tendency to distract (as assessed by the rumination and distraction subscales of the Response Styles Questionnaire) revealed moderate and statistically significant temporal stability across in-patient stay and four weeks after discharge. Post-discharge baseline rumination (four weeks) predicted follow up levels of depression at four months.

Longitudinal studies have also shown that initially non-depressed participants who demonstrate a ruminative response style to negative mood have a greater likelihood of experiencing a major depressive episode in the following 2.5 years as compared to those who did not exhibit a ruminative response style. Further, rumination mediated the relationship between the depressive episode and negative cognitive styles, self-criticism, dependency and history of past depression (Spasojevic & Alloy, 2001). This study demonstrated that rumination may predict increases in mood, but it may also be a critical factor above and beyond that of other known risk factors for depression. Thus, rumination may be a causal mechanism through which other factors lead to depression.

In another longitudinal study, Nolen-Hoeksema (2000) assessed participants for clinical depression, anxiety and ruminative response style. Rumination predicted depressive disorders, including new onsets of depressive episodes. Those who displayed depressive symptoms coupled with a ruminative style during the initial assessment experienced more severe and longer lasting depressive symptoms one year later and were less likely to show remission of their depression. These studies suggest that rumination may exacerbate the course of depressive episodes in clinically depressed patients (Lyubomirsky & Tkach, 2003).

Experimental studies have often involved assigning participants to either rumination or distraction conditions. Findings from these studies have demonstrated that
dysphoric participants, when induced to ruminate, experience greater increases in depressed mood than dysphoric participants induced to distract and non-dysphoric controls in either condition (e.g. Lyubomirsky, Caldwell & Nolen-Hoeksema, 1998; Lyubomirsky, Kasri, & Zehm, 2003; Trask & Sigmon, 1999). Much of the research on rumination and depression is based on non-clinical samples. Often samples have been defined as dysphoric or non-dysphoric groups as assessed using the Beck Depression Inventory (BDI). Participants scoring 16 or above the BDI are defined as dysphoric, and five or below as non-dysphoric. However, research with clinical populations supports the generalizability of these findings (Nolen-Hoeksema et al., 1999; Nolen-Hoeksema & Morrow, 1993, Nolen-Hoeksema, Parker & Larson, 1994; Sarin, Abela & Auerbach, 2005). Experimental research also consistently demonstrates the implications of rumination for both onset and maintenance of depression. Manipulations of rumination do not appear to induce depressed mood in non-dysphoric participants (e.g. Lyubomirsky et al., 1998; Morrow and Nolen-Hoeksema, 1990; Nolen-Hoeksema and Morrow, 1993). This suggests that it is the combination of dysphoria and rumination that maintains depressed mood.

2.4 Rumination and maternal sensitivity

Although the links between 1) rumination and depression and 2) PND and maternal sensitivity are well-established, there is as yet little evidence exploring how rumination may impact the relationship between PND and maternal sensitivity. Meins’ (1999) definition of maternal sensitivity implies a necessity for recognition, interpretation and appropriate response on the part of the mother. This suggests that both abilities and actions may play an important role in sensitive responding to the infant. It is therefore important to clarify the mechanisms through which rumination may influence both the abilities (e.g., attention, emotion recognition) and actions (e.g.,
behaviours such as avoidance and social problem solving) associated with maternal sensitivity. In the following sections evidence for the relationship between rumination and key mechanisms that may be necessary for sensitive maternal responding will be reviewed. Each will be considered in terms of how they may affect parenting ability if impaired by rumination.

2.4.1 Rumination and attentional processes

There is considerable evidence demonstrating that individuals with depression exhibit biases in attention, memory, and interpretation (see Peckham, McHugh & Otto, 2010; Joormann & Siemer, 2011). A large body of literature attributes these attentional biases in depression to a ruminative response style. Donaldson, Lam & Matthews (2007) examined attentional responses and rumination in major depression. The possible roles for rumination and distraction in increasing and lessening attentional biases for negative information were also explored. The dot probe task (Posner, Snyder & Davidson, 1980) was used to assess the effects of both induced and trait rumination and distraction on attention in patients with major depression and healthy controls. In the dot probe task, participants’ responses to a neutral probe are timed after it appears in the former location of one of two word stimuli that appear in different locations on the screen. Responses will be faster when the neutral probe appears in an attended rather than an unattended area of the computer screen, thus assessing the where exactly attentional resources are being used. Studies have demonstrated that depressed patients are slower to disengage from negative information compared to control groups, thus exhibiting a bias for negative information.

In Donaldson and Colleagues’ (2007) study, this bias was also found to be stronger in those individuals with high trait rumination. However, Joorman & Siemer (2011) stress that this study, among others (e.g., Bradley, Mogg, & Lee, 1997; Joormann & Gotlib, 2007) shows that depressed individuals do not direct their attention
to negative information more often than do control participants, but once their attention is focused on negative information they have difficulties disengaging from it.

In contrast, other studies have found that depressed individuals also tend to disengage more quickly from positive stimuli. Compared with controls, depressed participants have been found to both disengage more slowly from sad facial expressions and disengage more quickly from happy facial expressions (Levans & Gotlib, 2010). Bradely, Mogg & Millar (2000) also found depressive symptoms to be associated with reduced attentiveness to happy faces, but not a slower disengagement from sad faces in a dot probe task. A non-depressed group also maintained longer fixation on positive stimuli compared to currently depressed individuals when eye movements were recorded (Isaac, Vrijsen, Rinck, Speckens & Becker, 2014).

Donaldson & colleagues (2007) suggest that a ruminative response style may contribute to difficulties in disengaging from negative information above and beyond depression. This may be because rumination is playing a role in prolonging attention to information that is mood congruent; individuals who ruminate may get cognitively ‘stuck’ on mood congruent information, (e.g. Gilboa-Schechtman, Revelle & Gotlib, 2000; McNally, Riemann & Kim, 1990). In contrast, rumination may have less of a role in disengaging more quickly from positive information. Positive information is not mood congruent, therefore it is more likely to be discarded quickly or avoided altogether.

Davis & Nolen-Hoeksema (2000) also support the notion of ruminators becoming cognitively stuck. They suggest that there may be a relationship between cognitive inflexibility and rumination, making it difficult for people to switch their attention away from themselves and their problems to more pleasant or distracting topics and activities. Their study examined the performances of ruminators and non-ruminators (selected on the basis of their responses to the Response Styles
Questionnaire) on the Wisconsin Card Sorting Test (WCST) and other tasks measuring related cognitive processes. In the WCST the participant is asked to determine what rule should be used to sort cards in order to match key cards that vary in three dimensions (colour, shape, and number). Feedback is given to participants about the accuracy of their matches. The WCST assesses the participants’ ability to shift their cognitive set, or ways of thinking or perceiving (e.g. you are supposed to sort cards according to colour, then, without telling somebody, the solution shifts to say, shape). The individual only knows that the strategy they were using before no longer works. There’s a new solution now (e.g. shape) but they are not told what the solution is and need to use trial and error to figure it out. Those with cognitive flexibility are able to shift their set and work out the new solution. Ruminators made significantly more errors in this task and failed to maintain adaptive and beneficial cognitive sets significantly more often than non-ruminators. In light of these findings Davis and Nolen-Hoeksema proposed that ruminators may become cognitively ‘stuck’ in their approach to adapting to the environment even when their previous, and now obsolete, adaptation has been invalidated by negative feedback.

Levans, Muhtadie & Gotlib (2009) investigated the role of rumination in resource allocation in an effort to explain such findings. They proposed that cognitive deficits such as the difficulties with attention observed in depression may be due to the resource capturing properties of rumination. They found a strong correlation between brooding rumination scores and interference levels among depressed individuals compared to a non-depressed group in a dual-task version of the recency-probe task in which participants were asked to complete the probe task in either a high or low interference condition. These findings led Levans and colleagues to propose that depressed individuals who ruminate may find themselves continually having to resolve interference between rumination and a task at hand and also to reroute resources away
from ruminative thoughts in a manner similar to that demonstrated in the high-interference condition used in their study. Conflict such as this may have important implications for maternal attunement. If a mother who ruminates has to continually resolve interference from rumination, she may have fewer resources available to attend to the environment and parenting relevant tasks, resulting in less attention towards the infant and less capacity to pick up on and interpret infant cues.

It is possible that such observed biases in attention caused by rumination may extend to mothers experiencing depression in the perinatal period. Whilst research examining the relationship between attention and maternal depressive symptoms is sparse, such attentional biases have been observed in depressed pregnant women. Pearson, Cooper, Penton-Voak, Lightman & Evans (2010) examined attentional processes in antenatal depression. One hundred and one pregnant women at an average gestation of 11 weeks were recruited to test the hypothesis that depressive symptoms in early pregnancy disrupt attentional processing of infant emotion. Participants were asked to complete a computerized task which measured ability to disengage attention from infant and adult faces displaying negative positive and neutral emotions. Depressed pregnant women were quicker to disengage attention from distressed compared with non-distressed infant faces, demonstrating a diminished attentional bias towards infants with distressed faces.

Although these findings initially appear to contradict existing literature on rumination and attention, a clearer understanding of the pattern of these results may rest in examining the function of attentional bias. In adults, it is adaptive to turn away from the negative and towards the positive. In infants, however, negative emotion represents a care need, so it is adaptive to turn towards both negative and positive emotion. If rumination enhances a self-focused perspective, then rumination should reduce the amount of time individuals look at both happy and sad infant faces because both
emotions in the infant are not congruent with the depressed individual’s mood. Conversely, for adult faces rumination should prolong the time the individual looks at a negative emotion, because it is mood congruent.

Rumination is an abstract, over-general thinking style (Watkins & Teasdale, 2001) that has been related to self-focus (Smith & Alloy, 2009). Self-focus is defined by Carver (1979) as self-directed attention that can take on the form of focus on internal perceptual events, increased awareness of present or past behaviour, attitudes, or memories of previous events. This self-focus may be one explanation for the relationship observed in Pearson’s study. Individuals with depression are more likely to attend to and remember mood-congruent material (cf. Joorman & Siemer, 2011). Furthermore, according to a number of conceptualizations, rumination it is seen as an equivalent to self-focus; a type of self-reflection, or self-focused attention (Smith & Alloy 2009; Watkins, 2004). Therefore, those with a tendency to ruminate regularly are by definition also self-focusing on their own negative thoughts, feelings and memories. If a mother or pregnant women is experiencing depressive symptoms and has a ruminative response style, she may have a greater tendency to self-focus and turn her attention inwardly on her mood congruent negative thoughts and feelings. She may also do this more quickly. Consequently this may detract attention away from both the distressed or happy infant that needs a response from the mother, thus reducing maternal sensitivity.

2.4.2 Emotion recognition

The processing and recognition of emotion is a central concept in human interaction (Bourke, Douglas & Porter, 2010). Recognition of facial expression has been associated with major depression and some of the deficits in this ability, broadly encompassing accuracy of emotion perception and the intensity of emotion required to
identify emotions, may account for some of the difficulties observed in social interaction (Surguladze et al, 2004). The relationship between difficulties with perception of emotion and depression has been extensively examined (e.g. Joormann & Gotlib, 2006), and a recent quantitative review has identified a moderate deficit in both bipolar disorder and major depressive disorder (Kohler, Hoffman, Eastman, Healey & Moberg, 2011).

A number of studies have demonstrated the negative impact of depression on the ability to recognise emotion in faces (for a review see Demenescu, Kortekaas, den Boer & Aleman, 2010). Depressed individuals demonstrate good recognition accuracy for sad faces compared to non-depressed individuals but impaired recognition accuracy for other emotions (Gollan, McCloskey, Hoxha & Coccaro 2010). Furthermore, findings have demonstrated that depressed participants required significantly greater intensity of emotion to correctly identify happy expressions in a facial morphing task (Joormann & Gotlib, 2006).

It can be argued that trouble experiencing and recognising happiness is a key problem for depressed individuals, not just a bias towards negative emotions. Results from previous research exploring emotion recognition in depression have been fairly consistent in demonstrating that depression is associated with deficits in the processing of positive facial expressions (Deveney & Deldin, 2004; Yoon, Joormann & Gotlib, 2009). However, Arteche et al. (2011) conducted a study of emotion recognition in mothers with MDD and their results are in some ways contrary to recent studies with adult depressed samples.

The authors explored mothers’ ability to respond to infant cues. They argue that the quality of the mother-infant relationship largely depends on the mother’s ability to respond to her infant’s cues, which are often non-verbal. Eighty nine mothers (34 with Generalised Anxiety Disorder, 21 with Major Depressive Disorder, and 34 controls)
were asked to complete a ‘morphed infants’ faces task when their children were between 10 and 18 months old. This task required participants to view 70 happy and sad infant faces on a computer screen as they were gradually morphed from neutral to a full expression by increments of 2%. Participants were asked to indicate as soon as they thought they recognised the emotion by pressing the space bar, and they were then asked to label the emotion as either happy or sad.

In line with previous research, depressed participants were less likely than nondepressed controls to accurately identify happy infant faces (i.e. made more errors overall). The authors suggest that this is important because if mothers with PND have difficulty identifying their infants’ happy faces, this may make their responses to their infants less positive and more negative. However, it is interesting to note that the depressed group was quicker overall to recognise happy infant faces, whilst also making more errors in accuracy. This suggests that there may be a faulty processing of positive emotion. For example, depressed mothers may be overcompensating and trying to “find” positive emotion, but doing this unsuccessfully. Overall, these findings for the perinatal period with infant faces partially support that of existing literature, but in other ways demonstrate a potential difference in the way mothers in the perinatal period process emotion. It is argued that rumination may enhance such observed biases in emotion recognition. For example, the internal self-focus that is characteristic of rumination may interfere with the mothers ability to promptly and accurately recognise different infant emotions

These findings are in contrast with many other studies with depressed adult samples (cf. Gollan et al., 2010; Joorman & Gotlib, 2006) that indicate 1) good recognition accuracy for sad faces compared to nondepressed individuals but impaired recognition accuracy for other emotions and 2) a significantly greater intensity of emotion required to correctly identify happy expressions compared to nondepressed
individuals (also see Surguldaze et al, 2004; Yoon, Joormann & Gotlib, 2009). This begs the question as to why mothers experiencing depression may experience such an opposite bias of emotion to infant faces. Arteche et al. (2011) argue that it is probable that difficulties in appraisal of infant’s facial expressions will affect the quality of mother–infant interaction. Stein et al. (2010) found that mothers with PND also demonstrate an appraisal bias with regard to infant emotion. Forty five mothers (15 depressed, 15 anxious and 15 controls) were asked to rate on a likert-scale ranging from −9 to +9 a number of infant facial expressions ranging from very positive to very negative. Each face was shown twice for a short and then a longer period of time. Results showed firstly that mothers used more extreme ratings for emotions when shown them for the longer period of time. Secondly, mothers experiencing PND were more likely to rate more negatively than controls. This difference was found to be specific to depression rather than an effect of general postnatal psychopathology. These findings have important implications for the relationship between PND and maternal sensitivity. In particular, Arteche and colleagues (2011) argue that such difficulties in the ability to process positive facial expressions may lead to an impaired maternal responsiveness to positive affect in the infant, thus reducing the quality of mother–infant interactions.

A growing body of literature explores the role of rumination in emotion recognition. Higher levels of rumination in a depressed sample have been associated with higher levels of perception of negative emotion in facial expressions (Raes, Hermans & Williams, 2006). Twenty-six depressed patients completed the Perception of Facial Expressions Questionnaire, the Ruminative Response Scale, and other assessments of depressive symptoms. Rumination was found to be positively related to a negative bias in the judgment of facial expressions, after controlling for depression. Raes et al. (2006) suggest that the relationship between attentional bias and rumination
may also be implicated in the perception of facial expressions in individuals with depressive symptoms.

Joormann, Dkane & Gotlib (2006) further suggest that there is an association between a brooding response style (assessed using items from the rumination scale of the RSQ) and the tendency to maintain attention to negative stimuli. They found that the correlation between brooding ("a passive comparison of one’s current situation with some unachieved standard" Treynor, Gonzalez & Nolen-Hoeksema, 2003, p256) and an attentional bias for sad faces (as assessed using the facial dot probe task) remained significant when current depressive symptoms were taken into account.

Rumination exacerbates, prolongs and intensifies affective states (Nolen-Hoeksema & Morrow, 1993) and as such it is proposed that rumination will aggravate the relationship between depression and the associated deficits in emotion recognition. If a mother with low mood has a biased attention towards her infant’s negative facial expression, she may be more sensitive to the underlying emotional state of the infant and see the distress as worse or more negative than it is in reality. She may also recognise it more quickly. The question remains, however, as to what extent and in what manner such biases in interpretation of infant emotion translate into a mothers behavioural responsiveness to her infant. The findings of Stein and colleagues (2010) suggest that if a mother experiencing depression is more likely to judge negative emotions as more intense, it is possible that she may extend a similar attribution bias to her baby (e.g. my baby doesn’t like me).

2.4.3 Rumination and behaviour

A significant body of evidence demonstrates an association between depression and avoidant behaviour (see Ottenbreit, Dobson & Quigley, 2014, for an overview). Avoidance, defined as refraining or escaping from an action, person, or thing (DSM-5;
APA, 2013) has been posited as having a key role in depression (Ferster, 1973), promoting passivity and inactivity in depressed individuals. In more recent literature attention has turned to the relationship between rumination and avoidance. Cross sectional evidence has revealed significant correlations between cognitive (e.g. suppression) avoidance, behavioural (e.g. withdrawal) avoidance, rumination and depressive symptoms (Moulds, Kandris, Starr & Wong, 2007). Other studies have also demonstrated an association between rumination and experiential avoidance (avoidance of unwanted internal experiences such as thoughts, feelings and memories; e.g. Cribb, Moulds & Carter, 2006).

Dickson, Ciesla & Reilly (2012) also explored these relationships prospectively in a daily diary study. Adolescents completed daily measures of rumination, worry, behavioural avoidance, cognitive avoidance and negative affect for seven days. Lagged analyses indicated that greater daily rumination and cognitive avoidance predicted increases in daily sadness. Further, daily rumination and worry were predicted by daily cognitive, but not behavioural, avoidance. Rumination also mediated the effect of cognitive avoidance on daily sadness. These findings support the notion that rumination may function as a form of cognitive avoidance (Watkins & Moulds, 2004; Moulds, et al., 2007). Dickson et al. (2012) suggest that individuals may engage in rumination in an attempt to escape from their problems, with the rumination subsequently leading to continued depressed mood.

Research indicates that considering rumination as a form of cognitive avoidance may also be important in the perinatal period. Pregnant women who utilise a more avoidant coping strategy also report less social support and more depressed mood (Rudnicki, Graham, Habboushe & Ross 2001). Further, there is some evidence to suggest that cognitive avoidance of parenting stressors and affective state reduces maternal sensitivity to the infant in a play interaction task (Atkinson et al., 1995). It is
possible that mothers with a more avoidant coping style are engaging in rumination, which in turn leads to greater depressed mood and reduced sensitivity.

An alternative way to conceptualise the relationship between rumination and avoidance is that engaging in rumination itself may lead to avoidant behaviours. Mothers experiencing depressive symptoms have been found to exhibit reduced sensitivity through more avoidant and withdrawn behaviours when interacting with their infants (Malphurs et al., 1996). Furthermore, there is some evidence to suggest that rumination in depressed mothers may result in more withdrawn and unresponsive behaviours via decreased vocalisations with their infant in an interaction task (Stein et al., 2012). This is supported by the notion of rumination as functioning to avoid active engagement with the environment, and to avoid engaging in active problem solving in order to evade dealing with difficult circumstances and the associated distress (Moulds et al., 2007; Martell, Addis & Jacobson, 2001). This may be particularly pertinent in the postnatal period when a mother is experiencing difficulty in engaging with and responding to her infant and wants to avoid the potential distress associated with addressing this problem.

Social problem solving is another key mechanism that may be implicated in sensitive maternal responding. This aspect of parenting behaviour can also be affected by low maternal mood. Research has consistently linked social problem solving, or the problem solving activities that occur in social or interpersonal contexts (Nezu et al., 2007), to depressive symptomology in both clinical and non-clinical populations (Becker-Weidman, Jacobs, Reinecke, Silva & March 2010; Nezu, Nezu & Lombardo, 2004). Poor problem solving ability has been identified as a risk factor for depression (see Nezu, 2008), as a moderator between stressful life events and the onset of depression (Nezu & Ronan, 1985), and is associated with severity of depressive symptoms (Reinecke, DuBois & Schultz, 2001). Goddard, Dritschel, & Burton (1996)
also found that compared to nondepressed controls, depressed individuals demonstrate deficits on objective measures of problem solving ability (e.g., the Means End Problem Solving Task; MEPS, Platt & Spivack, 1975).

Studies have also suggested that rumination impairs problem solving ability in the context of depressive symptoms (e.g., Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999). Dysphoric participants who ruminated demonstrated poorer interpersonal problem solving on the MEPS task compared to dysphoric individuals who distracted themselves and non-dysphoric participants in both conditions (Lyubomirsky & Noen-Hoeksema, 1995). Dysphoric ruminators, compared to distractors, also rated their problems as more severe and unsolvable, and exhibited a reduced willingness to attempt to solve their problems (Lyubomirsky, Tucker, Caldwell and Berg, 1999). The results of this study further demonstrated that ruminative thinking in the context of dysphoric mood is characterised by a focus on personal problems combined with a negative tone, self-criticism and reduced self-confidence and perceived control.

These specific features of dysphoric rumination may have implications for the contexts in which rumination is particularly likely to have a negative impact on maternal sensitivity. Rumination may impact parenting for several reasons, including increasing the ambiguity of novel parenting situations and impacting social problem solving ability in parenting contexts. Research in the adult literature, for example, has demonstrated that individuals high in rumination are more likely to perceive greater uncertainty when faced with problems, to construe problems at a more abstract level (Watkins, 2008), and to be less confident about their solutions to problem situations (Ward, Lyubomirsky, Sousa & Nolen-Hoeksema, 2003). For example, in one study, rumination mediated the relationship between role ambiguity and early morning saliva cortisol secretion, a risk factor for Major Depressive Disorder (Rydstedt, Cropley &
Devereux, 2011), suggesting that greater role ambiguity led to more rumination, which in turn contributed to biological risk factors for depression. Thus, the parenting context, which frequently involves ambiguity, may prove especially difficult for parents prone to rumination. Babies have a relatively narrow range of communicative behaviours, expressions and cries for a wide and rapidly varying range of needs, thus creating ambiguous cues for parents. Although parenting an infant often requires immediate action, rumination may serve to amplify and maintain parenting stress, magnify ambiguity, and reduce both actual and perceived confidence in effective problem-solving needed to optimally resolve infant needs. Rumination may therefore serve to reduce maternal sensitivity. In support of this notion, in a recent study, postnatal dysphoric mothers induced to ruminate performed poorly on a measure of postnatal parental problem solving relative to postnatal dysphoric mothers induced to distract, and non-dysphoric postnatal mothers induced to either ruminate or distract (O’Mahen et al. 2013).

2.4.5 How might rumination be impacting the relationship between postnatal depression and maternal sensitivity?

I argue that rumination may be a mechanism explaining reduced maternal attunement, particularly in the context of postnatal dysphoric mood. Rumination plays a role in reducing attention and responsivity to the environment, leading to the mother being ‘preoccupied’ and therefore less able to be responsive to the infant’s social and emotional needs (cf. Stein, 2008). Rumination in postnatal depression has been investigated by a small body of research. Barnum, Woody & Gibb (2012) found that brooding rumination predicted maintenance of depressive symptom changes from pregnancy to two months postpartum. In another study Stein and colleagues (2012) also explored whether a rumination and worry prime in mothers with GAD and MDD
interfered with responsiveness to their 10 month old infants in a play interaction task. Compared to controls, the worry and rumination prime had a more negative impact on maternal responsiveness to infant vocalization in mothers with GAD, relative to a neutral prime. These mothers also demonstrated decreased vocalizations in the play task. A similar trend of reduced responsiveness to infant vocalization was observed to a lesser degree in mothers with depression that requires further investigation. In relation to this, Stein and colleagues note in their discussion the brevity of both the worry and rumination prime (5 minutes) and the observational periods (3.5 minutes). It is possible that a longer prime may have different effects, and a longer observational period may allow for a wider range of behaviours, responses and emotions to be identified both in the mother and the infant.

Rumination has also been implicated in difficulties with interpersonal relationships with other adults. For example, in a study of patients with Major Depressive Disorder, those who reported more self-focused rumination were rated to have significantly more severe problems in intimate relationships compared to patients who engaged in distraction (Lam, Schuck & Smith et al., 2003). Müller, Teismann, Havemann, Michelak & Seehagen (2012) propose that the association between rumination and difficulties in social functioning (for a review see Tse & Bond (2004) may not only be relevant to adult depression and peer relationships, but also to a mothers ability to build a strong bond with her infant in the context of low maternal mood. In support of this they found that ruminative thinking during pregnancy was predictive of self-reported impairments in the mother-infant relationship at five weeks postpartum as assessed by the Postpartum Bonding Questionnaire. Whilst further investigation is required to explore the role of rumination in the postnatal period, Müller and colleagues suggest that rumination may negatively bias how a mother interprets and responds to social stimuli from the infant. The authors further propose that the cognitive
resources required for social perception and interpersonal problem solving are being used elsewhere when a mother is engaging in rumination. This may be particularly pertinent given the ambiguous and often ‘open to interpretation’ nature of infant behaviours.

2.5 Summary: Rumination as a key mechanism in the relationship between maternal depressive symptoms and maternal attunement

In summary, there is a growing body of converging empirical evidence to support the overarching hypothesis of this thesis, that rumination is associated with impairments in maternal attunement. Further, the adult depression literature identifies rumination as being implicated in deficits in a number of behavioral (e.g. avoidance, social problem solving) and cognitive mechanisms (e.g. attention, emotion recognition), which may be important mechanisms associated with good maternal attunement. Moreover, the Response Styles theory of rumination (Nolen-Hoeksema et al., 1999) supports a rationale for hypothesizing that rumination may play a role in the exacerbation of depressive symptoms, including worsening dysphoric mood, increasing negative thinking and impairing key cognitive and behavioural mechanisms that are important for sensitive and responsive parenting.

Conversely, the Goal Theory of rumination (Martin, Tesser & McIntosh, 1993) would indicate that difficulties in the mother-infant relationship may be perceived as discrepancies in progress towards a higher level goal or outcome (e.g. being a good parent), which may give rise to dysfunctional rumination. This process may be particularly exacerbated if the mother is also experiencing depressive symptoms, which are also associated with a ruminative thinking style. Thus it is conceivable to predict
that the relationships between maternal attunement, rumination and depressive symptoms may be bi-directional (Figure 2.2).

Finally, although findings from a small but growing body of empirical studies are consistent with the hypothesis that rumination is associated with maternal attunement, these studies have largely examined concurrent associations, and have not used a range of measures to assess the multiple aspects of maternal attunement in the postnatal period. There is also a lack of longitudinal and prospective research examining the temporal relationships between rumination, attunement and depressive symptoms. It is important to increase understanding of both the temporal and causal nature of relationship between rumination and maternal attunement in order to determine the underlying factors that lead to rumination and poor attunement in the postnatal period.

To the author’s knowledge, only one experimental study to date has explored the causal role of rumination in impairments in mother-infant interaction behaviours (Stein et al., 2012), finding a non-significant trend of reduced responsiveness to infant vocalization in mothers with depression that warrants further investigation. However, Stein and colleagues used a prime that is more strongly related to worry than rumination which, it is speculated, may not have been powerful enough to elicit behavioural effects due to its lack of self-relevance. It is conceivable that a rumination induction that includes self-relevant material would not only be more powerful (Riemann & McNally, 1995; Brown & Taylor, 1986), but would also be more ecologically valid.

Based on this review of the literature, and the gaps identified, this thesis aims to address the following primary research questions. First, is rumination associated with impairments in maternal attunement? Second, do other contextual factors play a role in this relationship? Third, is there a temporal and causal relationship between rumination and maternal attunement, and if there is, what is the nature of this relationship? To build on existing findings and unpack the relationships between rumination, maternal
attunement and depressive symptoms, this thesis will address the limitations identified by a) conceptualizing maternal attunement as a multidimensional construct and assessing multiple aspects of attunement and their relationship with rumination b) using prospective and experimental designs to test the temporal and causal nature of the relationships between rumination and attunement at both a trait and state level and c) use a more ecologically valid, self-referential manipulation of rumination for a more valid assessment of its causal role in the disruption of maternal attunement.

2.6 Hypothesised thesis model

The proposed thesis model (Figure 2.2) outlines the hypothesised relationships between rumination, attunement and depressive symptoms, incorporating existing empirical findings relating to child outcomes and hypothesised relationships with contextual factors.
Figure 2.2:
Hypothesised thesis model

Note: Bold lines indicate primary thesis hypotheses. Dashed lines indicate that the direct relationship is predicted to be mediated by another variable. Grey lines indicate relationships that are not addressed in this thesis.

2.7 Thesis hypotheses

Hypothesis 1: Rumination is associated with impairments in maternal attunement, and mediates the effect of depressive symptoms on maternal attunement

This literature review suggests that maternal depressive symptoms are associated with poorer maternal attunement, and that this relationship may be explained by a ruminative thinking style. Rumination is associated with depressive symptoms both in the adult depression and maternal depression literature (e.g. Nolen-Hoeksema, Larson & Grayson, 1999; Nolen-Hoeksema & Morrow, 1991; Barnum, Woody & Gibb, 2003). There is also an association between rumination and maternal attunement in the
perinatal period, as well as growing evidence of its relationship with other key cognitive and behavioural parenting mechanisms (e.g. Pearson et al., 2010; O’ Mahen et al., 2013). As such, there is precedence for the hypothesis that rumination is associated with attunement. Building on this evidence, the first thesis hypothesis was that a concurrent association exists between rumination and maternal attunement, specifically in the postnatal period, and that rumination would mediate the effect of depressive symptoms in the postnatal period on poorer maternal attunement.

Maternal attunement was operationalized using trait measures of maternal responsiveness (MIRI; Amankwaa, Pickler & Boonmee, 2007) and maternal bonding (PBQ; Brockington et al., 2001) and a state measure of felt closeness with infant. This hypothesis was primarily tested in chapter 3 of this thesis (study 1), and also replicated in study 2, and again in study 3 at a state level.

Hypothesis 2: The role of contextual and infant factors; rumination mediates the effect of social support on maternal attunement, and infant temperament moderates the hypothesised thesis model.

Both self-report and laboratory observations of mother-infant interactions have shown that difficult infant temperament can be particularly problematic for maternal attunement when the mother is also suffering with postnatal depression (Pauli-Pott, Mertesacker, Bade, Haverkock & Beckmann, 2000). Infant temperament may therefore create particular parenting contexts in which rumination is more likely to occur, and this may be especially true when the parent is suffering from depressive symptoms. As such, we expected infant temperament to moderate the hypothesised thesis model. Specifically, we hypothesised that rumination would mediate the effect of depressive symptoms on maternal attunement when infant
temperament (operationalised using the Infant Behaviour Questionnaire: revised; IBQr, Gartstein & Rothbart, 2003) was perceived to be more difficult.

As summarised in the literature review, there is also considerable evidence demonstrating the important role social support plays as a buffer against postnatal depressive symptoms (see Beck, 2001 for a review). Recent research also revealed that social support prospectively buffers the effects of rumination on depressed mood (O’Mahen, Flynn & Nolen-Hoeksema, 2010). Thus, we also expected that social support (operationalised using the Social Provisions Scale; SPS, Russell & Cutrona, 1987) would also influence the relationship between maternal rumination and maternal attunement. We further predicted that mothers with high social support would have better maternal attunement, even when they had babies with difficult temperaments and were high in rumination (study 1).

_Hypothesis 3: Rumination in the context of maternal depressive symptoms causes impairments in maternal attunement_

The literature review summarises emerging empirical findings in the adult depression literature and the perinatal literature which suggest that ruminative thinking may adversely affect perceived maternal attunement via impairment of key cognitive and behavioural parenting related mechanisms. The conceptualisation of rumination as a self-focussing, avoidant coping style (Moulds, et al., 2007) also supports this notion. Thus, the third thesis hypothesis is that rumination would prospectively predict impairments in maternal attunement, and that the relationship between rumination and attunement would be moderated by depressive symptoms. Specifically, we expected the relationship to be significant when depressive symptoms were high, not low.

The first step in testing this hypothesis was to investigate the temporal relationships between rumination, depressive symptoms and maternal attunement. If
rumination affected maternal attunement, there is the possibility that it might also prospectively predict poorer outcomes (study 2). Because ruminative thought is argued to be an ongoing dynamic process that fluctuates over time (Moberly & Watkins, 2008) it was also deemed important to examine ruminative thought predicted maternal attunement in everyday contexts and settings, and in response to real emotional experiences between mother and infant that occur day by day. Thus, study 3 also explored the state relationships between rumination, attunement and maternal mood in a daily diary study.

However, demonstrating prospective relationships alone using self-report measures does not infer causality. It also only allows us to test perceptions of maternal attunement, as opposed to actual maternal behaviour. In order to determine whether rumination caused impairments in maternal attunement behaviours, it was necessary to use experimental methodology and manipulate rumination. In this way it was possible to test whether differences in a mother’s behaviour when interacting with her infant could be attributed to change in rumination (study 4). In order to test this, rumination was manipulated using a task adapted to be both self-relevant and parenting specific with the aim of increasing the strength of the induction (see section 6.4.2 for further details). Maternal attunement was operationalised using an objective measure of maternal behaviour. Specifically, mother-infant interaction behaviour during free play was scored from videotapes using the Child-Adult Relationship Experimental Index (CARE Index; Crittenden, 2004).

2.8 Secondary thesis hypotheses

Hypothesis 4: Rumination causes impairments in maternal attentional disengagement with distressed infant emotion

The literature review summarizes empirical research evidence which suggests that rumination may impair ability to pay attention to the environment (e.g. Donaldson,
Lam & Matthews, 2007), due to self-focussing, or avoidant behaviours. Attending to the environment may be a particularly important cognitive ability in effective maternal attunement (i.e. in order for the mother to respond sensitively and appropriately she will need to attend to the infant cues and emotions). Initial research in the field of attentional bias in the perinatal period demonstrates patterns of behaviour in mothers and pregnant women contrary to the general adult depression literature. Research has found that mothers show preferential processing of infant distress compared to non-mothers (Seifritz et al., 2003), whereas depressed pregnant women have been found to disengage attention more quickly from distressed compared with non-distressed infant faces, demonstrating a diminished attentional bias towards infants with distressed faces (Pearson, Cooper & Penton-Voak et al., 2010). As summarized in section 2.4.1 of the literature review, this contrasts with the adult depression literature, which demonstrates an attentional bias towards mood congruent information (for a review see Peckham, McHugh & Otto, 2010). Other research suggests that rumination may exacerbate the effects of depression on attention bias (e.g. Donaldson, Lam & Matthews, 2007). Thus, in an attempt to replicate the findings of Pearson and colleagues with a postnatal sample, the fourth thesis hypothesis was that mothers induced to ruminate would demonstrate an attentional bias away from infant distressed emotion, and that the effect of rumination on attentional bias would be moderated by depressive symptoms (Chapter 6, study 4; Appendix C).

Attentional bias was operationalised using a modified version (Pearson et al., 2010) of an established paradigm (Bindermann, Burton, Langton, Schweinberger & Doherty, 2005) designed to measure the participants ability to disengage attention from infant and adult faces displaying negative, positive and neutral emotions.
Hypothesis 5: Impairments in maternal attunement in the context of maternal depressive symptoms cause more rumination.

Whilst this thesis adopts a RST framework and conceptualises rumination as behaviours and thoughts that focus an individual’s attention on their depressive symptoms and on the implications of these symptoms (Nolen-Hoeksema, 1999), it also considered the relevance of Goal Theory (Martin et al., 1993) in understanding the role of rumination in the postnatal period. It is possible to observe RST and Goal progress theory as more interrelated (Figure 2.1) than separate. Higher order goals, such as being a good mother, may feel unaccomplished if the mother does not feel attuned with her infant. According to Goal Theory, it is this lack of progress towards such goals that may result in dysfunctional rumination, and also, low mood. Adopting a framework that interrelates these two models simultaneously allows for the notion of rumination as a function of depressed mood, but also predicts that environmental discrepancies in a parenting context (such as difficulties in bonding with infant) may also result in more rumination.

Consequently, the fifth hypothesis of this thesis is that impairments in maternal attunement in the context of maternal depressive symptoms would prospectively predict more rumination. If poor maternal attunement did concurrently affect level of rumination, then poorer maternal attunement might also prospectively predict higher rumination scores, as well as the reverse relationship being true. This hypothesis was tested simultaneously with thesis hypothesis two in studies 2 and 3.
CHAPTER 3: Maternal attunement and rumination: An initial investigation

3.1 Preface

The primary aim of the first thesis study (study 1) was to provide a preliminary test of the hypothesis that rumination is associated with maternal attunement (paths 1 and 2 as specified in the hypothesised thesis model, Figure 3.1). In order to determine whether rumination is causally implicated in poorer attunement I first sought to establish the concurrent relationship between these two constructs. Study 1 builds on theory and emerging empirical findings that rumination is significantly associated with aspects of maternal attunement (Barnum et al., 2008; Stein et al., 2012; Müller et al., 2013, see section 2.4.5). The current study aimed to replicate previous findings, confirming a relationship between rumination and attunement. Further, this study aimed to extend previous findings through an investigation of contextual factors (specifically social support and infant temperament) that have been established as playing a key role in the relationship between maternal depressive symptoms and maternal attunement, and the impact of rumination on these relationships. The paper reported in the main section of this chapter has been submitted for publication to Infant Behaviour and Development and is currently under review.
**Background**

Chapter 3 includes an exact copy of the paper as submitted for publication. In this preface section, further detail about the study procedure and analysis is provided. This was not included in the main paper in order to adhere to the journal’s word limit. The study used a volunteer sample of data collected from mothers who were approached both via online advertising on UK mother and baby websites and in community mother and baby groups within local children’s centres in the South West of England. Path Analyses using AMOS version 19 was used to model the hypothesised concurrent relationships between maternal depressive symptoms, rumination, maternal attunement, infant temperament and social support. Path Analysis assesses whether a hypothesised structural model can effectively reproduce observed item covariances using maximum
likelihood algorithms. Path Analysis allowed me to examine complete and simultaneous tests of all relationships and test a multitude of hypotheses as a whole, including group comparisons (Ullman & Bentler, 2003).

In the current study, the relationship between rumination and two different aspects of maternal attunement were investigated. Maternal attunement can be viewed as a multidimensional construct. Markova & Legerstee (2006) define attunement as responsiveness and warm sensitivity. This encompasses promptness, appropriateness of reactions and responsiveness to infant signals and behaviours. Attunement between mother and child can also be considered as directly affected by the maternal-infant bond (Mead, 2004; Klaus and Kennell, 1976), which can be defined as the thoughts, feelings and behaviours that are directed to maintain the mother's physical and psychological proximity to the child (Feldman et al., 1999). Conversely, maternal responsiveness includes appropriate maternal behaviours that are prompt, contingent, identifiable, and are carried out in direct response to cues given by the infant (Amankwaa et al., 2007). Because self-report measures were used in this study to assess attunement as opposed to observational measures, it was important to tap into different attributes of the mother infant relationship using these definitions. Thus, in the present study two independent aspects of attunement were assessed; responsiveness and bonding.

Recent research has also discriminated between different forms of rumination; reflection and brooding. Reflective rumination has been characterized as “purposeful turning inward to engage in cognitive problem solving to alleviate one’s depressive symptoms” (Treynor et al. 2003, p. 256) whereas brooding can be regarded as a passive comparison of one’s situation with some unachieved standards (e.g. “thinking about a recent situation, wishing it had gone better”; Treynor et al. 2003, p. 256). Nolen-Hoeksema (2008) posits that brooding rumination does not lead to active problem solving; an activity which has the potential to change the circumstances around the
cause of the distress. Rather, brooding results in a prolonged fixation on the problem and the distress, without taking action. In contrast, reflection may be more adaptive in the long term, because it leads to successful problem solving. Thus, rumination or preoccupied thinking in itself may not necessarily always be associated with negative outcomes. Rather, it may be the way that an individual ruminates that can be unhelpful and maladaptive, as well as the content of that rumination. Brooding in contrast to reflecting rumination has been associated with more depression both concurrently and longitudinally, whereas reflection rumination is less frequently associated with depression, particularly longitudinally (Treynor et al., 2003). This finding is supported in subsequent studies of subtypes of rumination in the perinatal period (e.g. Barnum et al., 2013). Furthermore, research has indicated that brooding, but not reflective rumination has been associated with avoidance in a non-depressed sample (Moulds, Kandris, Starr & Wong, 2007), and more attentional and memory biases towards negative stimuli in a depressed sample (Joorman et al., 2006); mechanisms that may be important aspects of sensitive and attuned parenting.

As a result of the distinction between brooding and reflection, we examined how brooding rumination was related to maternal attunement to the infant. Specifically, we hypothesised:

1. Postnatal depressive symptoms would be negatively associated with maternal self-reported attunement with the infant.

2. Infant temperament would moderate the effect of depressive symptoms on maternal attunement. Specifically, postnatal depressive symptoms would be inversely related to maternal self-reported attunement with the infant when infant negative temperament was high, but not when infant negative temperament was low.
3. Rumination would mediate the relationship between depression and attunement with the infant when negative infant temperament was high.

4. Depressive symptoms and social support would be negatively related, and rumination will mediate the effect of social support on maternal attunement.

Methods and results

Preliminary data analyses were conducted in PASW statistics, version 18. Data were initially checked for accuracy, missing data, outliers and normality through an examination of descriptive statistics and graphic representations of all key variables. Correlations were also examined to assess whether associations between variables were in the expected direction. Nonnormality was evident in all but one of the variables used in our models (Appendix A). While SEM parameters with maximum likelihood estimation are robust to nonnormality, fit indices and standard errors can be biased (Bollen, 1989; Byrne, 2001). Transformation of variables alone is unlikely to lead to a multivariate normal distribution and the transformation of variables can often lead the hypothesised SEM model to be unidentified or degraded in terms of fit indices (Gao, Mokhtarian, & Johnston, 2008). To address this issue (as discussed in the main section of this chapter) both traditional maximum likelihood methods, and bootstrapping ($N = 2000$) of maximum likelihood estimates were used to estimate parameters in order to evaluate potential bias.
3.2 Abstract

Postnatal maternal depressive symptoms are consistently associated with impairments in maternal attunement (i.e. maternal responsiveness and bonding). There is a growing body of literature examining the impact of maternal cognitive factors (e.g. rumination) on maternal attunement and mood. However, little research has examined the role of social support and infant temperament in this relationship. This study investigated the hypothesis that rumination would mediate 1) the relationship between depressive symptoms and attunement and 2) the relationship between social support and attunement when infant difficult temperament was high, but not low. Two hundred and three mothers completed measures on rumination, depressive symptoms, attunement, perceived social support and infant temperament. Contrary to our hypotheses, path analyses, revealed that rumination mediated the relationship between postnatal maternal depressive mood and maternal self-reported responsiveness to the infant when infants were low, but not high, in negative temperament. When infants had higher negative temperament, there were direct relationships between maternal depressive symptoms, social support and maternal self-reported responsiveness to the infant. These findings suggest potentially different pathways to poor maternal responsiveness than those
expected and provide new evidence for the unfolding relationship between maternal
attunement with infant, maternal rumination and maternal mood.
3.3 Introduction

Maternal attunement to the infant encompasses maternal bonding with the infant and the quality with which mothers are attentive, sensitive, and responsive to their infant’s cues (Legerstee, Markova & Fisher, 2007). Attunement has been consistently linked to positive child outcomes such as attachment security, language acquisition and maturity of object play (Bigelow et al., 2010; Tamis-Lemonda & Bornstein, 2002; Bigelow, MacLean & Proctor, 2004) and inversely related to negative maternal emotional characteristics such as depression (Field, 2010). Attunement has also been shown to mediate the relationship between maternal depression and negative cognitive and behavioural child outcomes (see Grace, Evindar and Stewart, 2003). However, little research has examined specific maternal cognitive mechanisms associated with maternal depression that may drive poor maternal attunement. Further, it is unclear how infant temperament and contextual factors such as social support are related to maternal cognitive processes, and the impact these may have on the mother’s ability to attend to and sensitively respond to her infant. This is important because a better understanding of the specific cognitive processes impacting on maternal attunement to her infant may provide clinicians with distinct targets for intervention. In this study we examine the role of maternal rumination in maternal depressive mood and maternal attunement.

3.3.1 Rumination, infant temperament and social support

In the broader depression literature, there is extensive correlational, prospective, and experimental evidence linking rumination, a repetitive style of thinking that “focuses an individual’s attention on their depressive symptoms and on the implications of these symptoms” (Nolen-Hoeksema, 1991, p.569), with the onset, severity and
maintenance of depression (Nolen-Hoeksema et al., 2008). Studies have demonstrated that rumination magnifies existing negative emotions and elaborates negative cognitions (Lyubomirsky & Nolen-Hoeksema, 1995; Watkins, 2008). As such rumination may be an important factor involved in maternal depression and attunement, involving a preoccupation with personal concerns, less sensitivity to the external environment and potentially focusing attention away from infant behavioural and emotional cues, and biasing attention towards negative stimuli (Stein et al., 2010).

In support of this notion, there is evidence that rumination has an important role in interpersonal functioning, with emerging support for the impact of rumination on the mother-infant relationship (Abbot & Rapee, 2004; Edwards, Rapee, & Franklin, 2003; Lundh & Sperling, 2002). These effects may be especially strong when the individual lacks a broader network of buffering social support (Nolen-Hoeksema & Davis 1999; O’Mahen et al. 2010). In a recent prospective study, antenatal rumination, as assessed by the Perserverative Thinking Measure (Müller et al., 2013), predicted lower feelings of self-reported bonding with the infant at 8 weeks postpartum. In an experimental study, mothers with Major Depression who were induced to ruminate versus distract demonstrated a trend towards reduced responsiveness with their infants (Stein et al. 2012). There is less research, however, examining broader infant specific and contextual factors in the mother-infant relationship that may affect the impact of rumination on maternal attunement.

Infant temperament may have a significant role on the relationship between rumination and maternal attunement. There is evidence from numerous studies supporting a direct relationship between infant temperament and maternal attunement throughout the first postpartum year (e.g. Seifer et al, 1996; Kivijarvi, et al., 2005) with negative affectivity being implicated as a particularly important infant behavioural index (Tikotzky et al., 2010; Pesonen et al., 2005; Austin et al., 2005). Although
negative infant temperament can be challenging for most parents, both self-report and laboratory observations of mother-infant interactions have shown that maternal attunement to infants with difficult temperaments is especially problematic when the mother is also suffering with postnatal depression (Pauli-Pott et al. 2000). The stress caused by negative infant temperament may therefore create particular parenting contexts in which rumination is more likely to occur, and this may be especially true when the parent is suffering from postnatal depression.

As there is considerable research demonstrating that both instrumental and emotional support play an important buffering role against the stress associated with negative infant temperament (Crockenberg, 1981) and postnatal depression (see Beck, 2001 for a review), we expected that social support may also influence the interplay of infant temperament, maternal rumination and depressive mood. This is further supported in research demonstrating that social support prospectively buffers the effects of rumination on depressed mood (O’Mahen et al. 2010).

3.3.2 The Present Study

We propose that in the context of low maternal mood, rumination may be related with poorer maternal attunement towards an infant with a difficult temperament. Brooding, a passive comparison of one’s situation with some unachieved standards (e.g. “thinking about a recent situation, wishing it had gone better”; Treynor et al. 2003, p. 256) in contrast to reflecting rumination has been associated with more depression both concurrently and longitudinally (Treynor et al., 2003). As a result of this distinction, we examined how brooding rumination in particular was related to maternal attunement to the infant.

Consistent with previous literature, we expected that postnatal depressive symptoms would be negatively associated with maternal self-reported attunement with
the infant. We also predicted that infant temperament would moderate this relationship. We hypothesized that postnatal depressive symptoms would be inversely related to maternal self-reported attunement with the infant when infant negative temperament was high, but not when infant negative temperament was low. We further hypothesized that rumination would mediate the relationship between depression and attunement with the infant when negative infant temperament was high. Finally, because there is significant evidence in both the postnatal depression and rumination literature on the role of interpersonal factors impacting broadly on both processes, examined the relationship between postnatal depression, rumination, and maternal relationship with the infant whilst also considering broader social support processes and the temperament of the infant. We hypothesized that depressive symptoms and social support would be negatively related, and that rumination would mediate the relationship between social support and maternal attunement when infant negative temperament was high, but not low (Figure 3.2).

Figure 3.2:
Rumination is predicted to mediate the relationship between maternal mood and maternal attunement when infant negative temperament is high but not low. Rumination is also predicted to mediate the relationship between perceived social support and maternal attunement when infant temperament is high but not low.

Participants were 203 mothers with infants aged between nine and 14 months. This age range was chosen because the mother-infant relationship emerges reliably
during this period. (Benoit, 2004). Participants were approached both via online advertising on UK mother and baby websites and in community mother and baby groups within local children’s centres in the South West of England. The mean age of mothers was 31.45 years (SD = 5.25). Infant mean age was 11.28 months (SD = 1.71). The majority of mothers were of British nationality (90.5%, n = 183) and had received a higher education degree (64.2%, n = 130). The majority (63.2%, n = 128) of mothers were primiparous.

3.4.2 Measures

**Maternal Attunement**

*Maternal Infant Responsiveness Instrument* (MIRI; Amankwaa, Pickler and Boonmee, 2007). The MIRI is a 22-item scale measuring the mother’s recognition of her own responsiveness, her recognition of her infant’s responsiveness to her, and difficulties in responsiveness (e.g. “I believe I can comfort my baby when he/she cries”). The MIRI has satisfactory validity and reliability with premature, perinatal and postnatal populations (Amankwaa, Younger, Best and Pickler, 2002). Cronbach’s Alpha in this study was .88.

*Postpartum Bonding Questionnaire* (PBQ; Brockington et al., 2001). The PBQ is a 25 item measures assessing a mother’s feelings or attitudes towards her baby (e.g. “I feel close to my baby”, “My baby irritates me”), with higher scores indicating poorer bonding. It has been successfully validated in previous studies (e.g. Brockington et al., 2006) and is comprised of four subscales; Impaired bonding, rejection and anger, infant focused anxiety and incipient abuse. Test-retest reliability was 0.95, 0.95, 0.93 and 0.77 respectively for the four subscales (Brockington et al., 2006; Brockington et al., 2001). Cronbach’s Alpha in this study was .92.
Depressive symptoms were assessed with the 10 item Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden and Sagovsky, 1987) assessing depressive mood over the past 7 days. The EPDS is a well-established instrument, validated for the screening of depression in the postpartum period. It has been successfully validated in a number of studies (e.g. Bergant et al, 1998; Cox et al, 1996) and demonstrated excellent internal consistency in this study ($\alpha = .91$).

Rumination was assessed with the 25 item revised Response Styles Questionnaire (Revised; RRS; Treynor et al. 2003). The revised version allows for the assessment of two different components of rumination; reflection and brooding. Scores were calculated for each component. Previous studies reported acceptable convergent and predictive validity for the Ruminative Responses Scale (e.g. Butler & Nolen-Hoeksema, 1994; Nolen-Hoeksema & Morrow, 1991). Cronbach’s alpha’s were .85 and .82 for the brooding and reflective subscales respectively.

Infant temperament was assessed using the Infant Behaviour Questionnaire-Revised short-form - negative affectivity subscale (IBQ-r NA; Gartstein and Rothbart, 2003). The hypotheses for the present study focus only on items that load the Negative Affectivity factor (see Gartstein and Rothbart, 2003 for a detailed description of these scales). Research has found negative affectivity to be a particularly important behavioural index when predicting maternal responsiveness (c.f. Tikotzky, Chambers, Gaylor and Manber, 2010; Pesonen, Raikkonen, Strandberg, and Jarvenpaa, 2005). Consequently the present study focussed on this aspect of infant temperament. The negative affectivity scale demonstrates adequate internal consistency in this study ($\alpha = .77$).
Perceived social support was assessed using the 24 item Social Provisions Scale (SPS; Cutrona and Russell, 1987), which examines the degree to which respondent’s social relationships provide various dimensions of social support including attachment, social integration, reassurance of worth, reliable alliance, guidance, and opportunity for nurturance. It has good validity (Norris & Kaniasty, 1996; Thompson, Norris, & Ruback, 1996). Internal consistency of the SPS in this study was .94.

Demographics Participants were asked to provide information on their age, the age of their infant, how many children they had in total, their nationality and level of education.

3.4.3 Procedure

The study was approved by the University of Exeter, School of Psychology ethics committee. All participants completed the study online using Qualtrics online survey software and indicated consent prior to taking part. Once consent was given a link was made available to a series of questionnaires. Completion time was approximately 45 minutes. Questionnaires could be completed in one sitting or over two or more sessions using a save and continue function. After completion, participants received a written debriefing that thanked them for taking part and reminded them of the nature of the study.

3.5 Data analysis

The relationships between infant temperament, mood, maternal attunement and rumination were examined using path analysis with SPSS AMOS 19. The traditional full information maximum likelihood estimator approach to parameter estimation assumes that continuous variables in the model are normal at the univariate and
multivariate level. Nonnormality was evident in several variables used in our models, and the data violated the assumption of multivariate normality (Mardia’s coefficient = 17.24). Therefore, two approaches to parameter estimation were employed; traditional maximum likelihood methods, and bootstrapping (n= 2000) of maximum likelihood estimates in order to evaluate potential bias. For the bootstrapping analysis, overall fit of the models was calculated using the Bollen-Stine bootstrap approach in place of the chi-square statistic (Bollen and Stine, 1993). All reported results are from the bootstrap analysis. Conclusions were consistent across the two estimation approaches. AMOS requires full data to run bootstrapping and calculate the Bollen-Stine p value. Thus, because missing data in the final sample were minimal (i.e. less than 5%) two cases with missing data (1.5%) were deleted from the dataset (Fitchman and Cummings, 2003). Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (EPDS, Tolerance = .37, VIF = 2.74; RRS Brooding, Tolerance = .42, VIF = 2.36; SPS, Tolerance = .69, VIF = 1.46; IBQ negative affect, Tolerance = .99, VIF = 1.00; MIRI, Tolerance = .73, VIF = 1.35; PBQ, Tolerance = .59, VIF = 1.62).

A number of additional goodness of fit indicators are recommended in order to assess model suitability. The $\chi^2$ goodness-of-fit test statistic assesses how much variance in the model is unexplained. Nonsignificance suggests good fit. A root mean square error of approximation (RMSEA) below .05 also suggests a well-fitting model along with a nonnormed fit index (NNFI) above .95 and a comparative fit index (CFI) above .95 (Bentler, 1995; Hu and Bentler 1999; Rigdon, 1996). Based on author guidelines the aforementioned indices of fit will be reported for all models.

The moderating effects of infant temperament in the association between rumination, depressive symptoms, and maternal attunement were examined using nested model, multigroup comparisons (Byrne, 2001). This approach is appropriate in this
circumstance due to the expectation that infant negative affect will moderate the whole model, rather than a particular variable within the model itself. In this approach a median split distinguished between persons reporting high \((M = 4.15, SD = .52)\) and low infant negative affect \((M = 2.81, SD = .40)\), \(t(201) = 20.65, p < .001\). An identical model was then simultaneously generated for infants reported as displaying more or less negative affect. Nested models were generated for both maternal responsiveness and maternal bonding (Figures 2 and 3 respectively). Model equivalence was tested between high and low infant negative affect temperament by constraining all pathways in the model to be the same between each group. If this model was not a good fit with the data, it indicated that negative affect temperament had a moderating effect. Where model equivalence was not accomplished (i.e. the model was not a good fit with the data), constraints on individual pathways were systematically loosened and permitted to vary between groups based on theoretical rationale and statistical improvement of model fit. When good model fit was achieved, the pathways allowed to vary between the models denote significant differences between greater or less infant negative affect.

### 3.6 Results

#### 3.6.1 Descriptive statistics

Pearson correlation analyses were conducted to examine the interrelationship among the main study variables. See Table 3.1 for correlations, means and standard deviations. Consistent with previous literature, the correlations between depressive mood and rumination were the most substantial \((r’s > .70)\). As predicted, brooding rumination was also significantly related to maternal responsiveness, maternal bonding and infant negative affect temperament. There were also significant, although weaker correlations between reflective rumination subscale and maternal responsiveness, maternal bonding and infant negative affect.
3.6.2 Infant temperament, mood, rumination and maternal responsiveness; moderator effects

A nested model was used to test for moderating effects of infant negative affect on the association between mood, rumination and maternal responsiveness. All pathways were constrained between groups to test for model equivalence. The fully constrained model was a poor fit with the data (Bollen-Stine $p = .032$, $\chi^2 (6) = 19.66$, $p = .003$, CFI = .95, NNFI = .93, RMSEA = .11), suggesting that the models were not similar for persons who reported high versus low infant negative affect and indicating a moderating effect of infant temperament. A model allowing pathways from (1) rumination to maternal responsiveness and (2) mood to maternal responsiveness and (3) social support to maternal responsiveness to vary was a good fit with the data (Bollen-Stine $p = .385$, $\chi^2 (3) = 3.09$, $p = .378$, CFI = 1.000, NNFI = .99, RMSEA = .012). A Chi square difference test confirmed that the model was significantly improved ($\chi^2 (3) = 16.57$, $p < .05$). Parameter estimates for each pathway for participants reporting lower and higher infant negative affect can be seen in Figures 3.3a and 3.3b respectively.

For those who reported their infants to be high in negative affect, no relationship was observed between brooding rumination and maternal sensitivity. Further, in this model social support was negatively related to depressive symptoms as predicted, but contrary to expectations, rumination did not mediate the relationship between social support and maternal responsiveness. Instead, a direct significant relationship between depressive symptoms and maternal responsiveness was observed, and social support partially mediated the relationship between depressive symptoms and maternal responsiveness. Therefore, when infant temperament is perceived to be more difficult, rumination does not mediate the relationship between maternal depressive symptoms and self-reported maternal responsiveness to infant.
However, for mothers reporting infants lower in infant negative affect, when the same pathways were allowed to vary between groups brooding rumination fully mediated the relationship between depressive symptoms and maternal responsiveness. The Sobel test confirmed this (path $a$; maternal mood and brooding rumination, $\beta = .46$, ($SE = .04$), path $b$; brooding rumination and maternal responsiveness, $\beta = .84$ ($SE = .32$), $z = 2.56$, $p = .005$). In this model, social support was negatively related to depressive symptoms, but it did not mediate the relationship between mood and maternal responsiveness.

A reverse mediation model was also estimated in which brooding rumination was the predictor variable, and maternal responsiveness was the mediator. This model was also a good fit with the data (Bollen-Stine $p = .27$, $\chi^2$ (2) = 3.60, $p = .17$, CFI = .99, NNFI = .98, RMSEA = .06). For mothers reporting infant negative affect in this model again no relationship was observed between maternal responsiveness and brooding rumination. For mothers who reported infant negative affect as low, maternal responsiveness only partially mediated the relationship between depressive symptoms and brooding rumination. The Sobel test confirmed this (path $a$; maternal mood and maternal responsiveness, $\beta = .46$, ($SE = .11$), path $b$; maternal responsiveness and brooding rumination, $\beta = .08$ ($SE = .03$), $z = 2.20$, $p = .01$).

3.6.3 Maternal bonding

A second nested model was used to test for moderating effects of infant negative affect on the association between mood, rumination and maternal bonding. Model equivalence was tested between those with high and low infant negative affect by again constraining all pathways to be the same between the groups. The fully constrained model (Figure 3.4) was an adequate fit with the data (Bollen-Stine $p = .18$, $\chi^2$ (6) = 11.93, $p = .06$, CFI = .98, NNFI = .96, RMSEA = .07) suggesting that the models were
similar for persons who reported high versus low infant negative affect and no moderating effect was present. In the fully constrained model, depressive symptoms were significantly associated with maternal bonding, but not brooding rumination or social support. Depressive symptoms were also negatively associated with social support, but contrary to predictions rumination was not associated with bonding, and did not mediate the relationship between depressive symptoms and bonding, or social support and bonding.
Table 3.1.

Pearson correlations and summary of means and standard deviations of the measured variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EPDS</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.86</td>
<td>5.96</td>
</tr>
<tr>
<td>2 RRS (total)</td>
<td>-.77**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.21</td>
<td>16.67</td>
</tr>
<tr>
<td>3 RRS (brooding)</td>
<td>-.75**</td>
<td>.91**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.81</td>
<td>3.80</td>
</tr>
<tr>
<td>4 RRS (reflective)</td>
<td>-.61**</td>
<td>.87**</td>
<td>.68**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.75</td>
<td>2.83</td>
</tr>
<tr>
<td>5 MIRI</td>
<td>.46**</td>
<td>-.40**</td>
<td>-.39**</td>
<td>.33**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>30.77</td>
<td>9.02</td>
</tr>
<tr>
<td>6 PBQ</td>
<td>.53**</td>
<td>-.51**</td>
<td>-.42**</td>
<td>.30**</td>
<td>.45**</td>
<td>--</td>
<td></td>
<td></td>
<td>35.70</td>
<td>12.23</td>
</tr>
<tr>
<td>7 IBQ-r –NA</td>
<td>-.22**</td>
<td>.22**</td>
<td>.18**</td>
<td>.18*</td>
<td>.16*</td>
<td>.24**</td>
<td>--</td>
<td></td>
<td>3.50</td>
<td>.86</td>
</tr>
<tr>
<td>8 SPS</td>
<td>.56**</td>
<td>-.45**</td>
<td>-.44**</td>
<td>-.32**</td>
<td>.39**</td>
<td>.42**</td>
<td>-.13</td>
<td>--</td>
<td>81.47</td>
<td>11.77</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p <.001

EPDS = Edinburgh postnatal depression scale, RRS = Ruminative Response scale, MIRI = Maternal Infant Responsiveness Instrument, PBQ = Postpartum Bonding Questionnaire; IBQ-r NA = Negative affect subscale of the Infant Behaviour Questionnaire revised, SPS = Social Provisions Scale
**Figures 3.3a and 3.3b:**

Standardised estimates for model predicting maternal responsiveness from mood and rumination variables for infants reported by mothers as high (first model, n = 101) and low (n = 102) in negative affect. *p < .05, **p < .01, ***p < .001.

High negative infant temperament

Low negative infant temperament
Figure 3.4:

Standardised estimates for the fully constrained model predicting maternal bonding from mood and rumination variables. A fully constrained model was a good fit with the data, suggesting no moderating effect of infant temperament *p < .05, **p < .01, ***p < .001.
3.7 Discussion

This study demonstrated that brooding rumination is related to two self-reported aspects of mother attunement, maternal bonding and responsiveness. For maternal responsiveness this relationship was moderated by infant temperament. In contrast, the relationship between maternal bonding and brooding rumination was not moderated by infant temperament, and there was no relationship between rumination and bonding in the un-moderated model.

In the model predicting maternal responsiveness, maternal depressive symptoms were associated with lower perceived social support across both high and low negative infant temperament. However, when infants were high in negative temperament, both depressive symptoms and lower perceived social support were also related to poorer maternal responsiveness. These results replicate and extend previous findings on negative infant temperament, social support, mood and responsiveness by considering the impact of rumination in these relationships. Previous literature has demonstrated that when an infant has high negative temperament, a mother’s emotional state and her level of perceived available support are associated with how well she responds to her infant and how bonded she feels with her infant. For example, Cutrona and Troutman (1986) demonstrated that negative infant temperament was related to maternal depressive symptoms, and that social support exerted a protective function against this effect. More recently, Pauli-Pott et al. (2000) have also found that maternal depressive symptoms were prospectively associated with low maternal sensitive responding when infant negative emotionality was high but not low, and Kivijarvi et al. (2004) found that infants of mothers exhibiting greater maternal sensitivity behaviour were more contented and cried less. These mothers also reported a greater level of social support from close family and friends. Similarly, in this study we found a negative relationship between maternal depressive symptoms and social support. Further, in the context of
having an infant with a more difficult temperament, perceived maternal responsiveness was poorer when the mother reported feeling less supported.

3.7.1 Pathways to poorer maternal responsiveness

Contrary to our hypothesis, an unexpected pattern of results was observed with respect to the pathways leading to poorer self-reported maternal responsiveness in dysphoric mothers. When infant negative affect was high, rumination was not related to self-reported maternal responsiveness. When infants were low in negative temperament however, rumination mediated the relationship between depressive symptoms and maternal self-reported responsiveness to the infant. These findings highlight potentially different pathways between maternal mood, rumination and poor maternal responsiveness than those expected. Whilst this is only preliminary data with self-report measures, it suggests that infant temperament may have an important role in whether rumination affects maternal responsiveness in the context of maternal depressive symptoms. Specifically, rumination may be more problematic when the infant is not perceived to be especially difficult, rather than when the infant is perceived to have a difficult temperament. The broader literature on worry and rumination may inform these interesting, albeit unexpected, findings. Previous research has demonstrated that people who ruminate do so because they believe that it aids insight and understanding into situations (Kingston, Watkins and O’Mahen, 2013), and Brewin (1999) argues that attributional activity is provoked by novel and unfamiliar stimuli that demand interpretation. Thus, it may be that rumination is more likely to be provoked when the parent is experiencing dysphoric feelings and the parenting situation is potentially causally ambiguous (e.g., “why am I unhappy in parenting? My baby seems fine.”) Although research that directly measures perceptions of ambiguity and attributions for causality are needed to directly assess this explanation, the current study provides initial
evidence that in high negative-affect temperament babies, maternal depressive symptoms and low perceived social support have direct relationships with maternal self-reported responsiveness, whilst in low negative-affect temperament babies, where the causes of low mood and possible dissatisfaction may be less clear, rumination mediates the relationship between maternal depressive symptoms and her self-reported responsiveness.

3.7.2 The function of rumination in the postnatal period

The results of the current study have implications for considering the function of rumination for mothers in the postnatal period. Nolen-Hoeksema’s (1991) response styles theory proposes that rumination focuses the individual's attention on his or her emotional state and inhibits any actions that might distract the individual from his or her mood. It is possible that for postnatal mothers rumination may serve a purpose that is more specifically parenting focused. Goal progress theory (Martin, Tesser and McIntosh, 1993) conceptualises rumination as repetitive thinking about goal discrepancy. This definition proposes that rumination is not a reaction to mood per se, but instead a response to failure to reach a goal. Parenting-specific goals may include, for example, to be a good mother or to be able to appropriately understand the wants and needs of the infant. Lack of clear and consistent feedback (from the infant) to provide evidence of progress towards such goals may lead to engaging in ruminative activity (Martin & Tesser, 1989, 1996; Martin, Tesser, and McIntosh, 1993). It may therefore be appropriate to explore rumination as a function of goal progress in the postnatal period in future research.
3.7.3 Limitations

Some limitations to this study suggest that interpretation of results and suggestions for future directions should be conducted with care. This study is limited by its cross-sectional and correlational nature. The current study identifies some interesting relationships; however both prospective and experimental studies are required in order to identify the causal nature of the associations identified. A prospective design may also allow for the identification of interactions between factors known to be related to postnatal depression in mothers who are making the transition through the first years of their infant’s life. A second limitation of this study is the lack of diversity in the sample. It will be important in future studies to replicate these results with a broader sample of mothers from different cultural and socioeconomic backgrounds, and to identify a wider sample of women who meet criteria for postnatal depression.

It is also important to note that the EPDS and the RRS were highly correlated in this study (Table 3.1). This raises questions as to the independence of these variables from one another (although research has demonstrated that rumination and depressive symptoms are independent of one another, e.g. Roberts, Gilboa, & Gotlib, 1998). However, this high correlation between depressive symptoms and rumination suggests that it is necessary to be cautious when interpreting the results due to the potential difficulties caused by collinearity. Coefficients biased by collinearity might cause variables that have no significant relationship with the outcome when considered in isolation to become highly significant in conjunction with collinear variables, leading to greater risk of Type I error. Alternatively, there is also the possibility that coefficients may show no statistical significance because of incorrectly estimated wide confidence intervals, leading to greater risk of Type II error. However it is notable that in this study both the EPDS and the RRS were significantly related to measures of maternal
attunement as independent variables. Furthermore, tests indicated that the data met the assumption of collinearity.

Fourth, the Maternal-Infant Responsiveness Instrument assesses a mother’s awareness of her infant needs and behaviours, rather than her ability to respond appropriately to her infant per se (e.g. “I believe I know when my baby needs me to feed him/her” and “I feel good about how I respond to my baby”). Stein et al. (2012) have demonstrated through observation of mother-infant interaction that a worry/rumination prime does lead to an impaired ability to respond appropriately to the infant in mothers with Generalized Anxiety Disorder, and to a lesser extent maternal depression. However, given the novel pattern of findings observed in the present study, it will be important to attempt to replicate these using alternative methods of assessing maternal attunement, such as observational techniques.

Finally, it is of note that the pattern of results observed with maternal responsiveness in this study was not replicated with maternal bonding. Whilst both responsiveness and bonding as assessed in this study can be considered as aspects of maternal attunement that should be explored together, it is noteworthy that when each was assessed independently the models resulted in a different pattern of findings. This may speak to the way in which self-report methods tap into different aspects of the mother-infant relationship and suggests that responsiveness and bonding may be two different properties of maternal attunement. It is possible that rumination has a particular impact on specific parenting behaviours related to responsiveness, but not bonding, which should be addressed in future research. Future research should also consider using multiple measures in order to pick up on the multiple aspects of the mother-infant relationship.

Alternatively, it is important to consider more general limitations of using self-report methods to assess bonding such as social desirability bias. The Postpartum
Bonding Questionnaire asks intimate questions about the mother-infant relationship (e.g. “I resent my baby”, “I wish my baby would somehow go away” and “I regret having this baby”) that a mother may not feel comfortable answering accurately. This again emphasises the importance of assessing bonding using alternative, more objective methods in future research.

3.7.4 Conclusions

The results of the present study have demonstrated a novel and unexpected relationship between infant temperament, rumination and maternal responsiveness. These findings are of note because they suggest potentially unexpected pathways to poorer maternal responsiveness when the mother is feeling low and infant negative temperament is lower, rather than high. These findings build on our understanding about how specific cognitive processes such as rumination impact the mother’s ability to sensitively respond to her infant and highlight a need to investigate the role of rumination in specific parenting contexts. The relationships explored in this study may provide an interesting framework for further exploring the role of rumination in postnatal depression, and the specific contexts or circumstances under which this may occur.
Footnotes

1 Although maternal bonding and maternal responsiveness are considered in the present study as two separate aspects of maternal attunement, we also investigated whether they may be entered into the hypothesised model as a latent variable. To test whether a latent variable comprised of maternal responsiveness and maternal bonding provided a good fit to the data, Confirmatory Factor Analysis was used to estimate a model and its fit to the data. Based on the fit indices, the maternal attunement as a latent variable was a poor fit with the data (Bollen-Stine $p = .385$, $\chi^2 (1033) = 4032.63$, $p < .001$, CFI = .63, NNFI = .55, RMSEA = .13. Therefore, analysis was continued as planned with identical models being run first for maternal responsiveness, then maternal bonding.


**Appendix A: Normality and distribution of study variables**

Prior to conducting the main analysis, normality of variable distribution was checked both by investigating skewness and kurtosis, and visually examining the shape of each distribution. All variables with the exception of infant negative affect temperament demonstrated skewness ranging from moderate to substantial. The Table 3.1 presents skewness and kurtosis values for each variable and Figures 3.5 to 3.10 illustrate the distributions for each variable.

**Table 3.2**

Skewness and kurtosis values for study variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. EPDS</td>
<td>.69</td>
<td>-.18</td>
</tr>
<tr>
<td>2. RRS – brooding</td>
<td>1.04</td>
<td>.24</td>
</tr>
<tr>
<td>3. SPS</td>
<td>-.81</td>
<td>-.37</td>
</tr>
<tr>
<td>4. MIRI</td>
<td>2.81</td>
<td>11.97</td>
</tr>
<tr>
<td>5. PBQ</td>
<td>2.41</td>
<td>7.30</td>
</tr>
<tr>
<td>6. IBQr – NA</td>
<td>.28</td>
<td>-.39</td>
</tr>
</tbody>
</table>

Note: EPDS = Edinburgh postnatal depression scale, RRS – brooding = Brooding subscale of the Ruminative Response scale, MIRI = Maternal Infant Responsiveness Instrument, PBQ = Postpartum Bonding Questionnaire; IBQr NA = Negative affect subscale of the Infant Behaviour Questionnaire revised, SPS = Social Provisions Scale
Figure 3.5:
Histogram (with normal curve) of maternal depressive symptoms (EPDS).

Figure 3.6:
Histogram (with normal curve) of brooding rumination (RRS brooding).
Figure 3.7:
Histogram (with normal curve) of perceived social support (SPS).

Figure 3.8:
Histogram (with normal curve) of maternal responsiveness (MIRI).
Figure 3.9:
Histogram (with normal curve) of maternal bonding (PBQ)

Figure 3.10:
Histogram (with normal curve) of Infant negative affect temperament (IBQr NA).
Appendix B: Infant negative affect as a moderator of the relationship between brooding rumination and maternal attunement.

Additional analyses were run in order to examine whether infant temperament moderated the relationship between brooding rumination and maternal attunement within the model, as opposed to moderating the whole model. In this model, brooding rumination, infant negative affect and their interaction term were entered as predictors of maternal attunement (independent models were run for maternal responsiveness and maternal bonding; Figure 3.11). The model predicting maternal responsiveness was a poor fit with the data (Bollen-Stine $p = .005$, $\chi^2 (7) = 742.49$, $p < .001$, CFI = .28, NNFI = .29, RMSEA = .71), as was the model predicting maternal bonding (Bollen-Stine $p = .005$, $\chi^2 (7) = 742.47$, $p < .001$, CFI = .31, NNFI = .32, RMSEA = .71). Thus, it was concluded that it was more appropriate to consider infant negative affect as a moderator of the model as a whole, rather than the relationship between brooding rumination and maternal attunement within the model.
Infant negative affect is predicted to moderate the relationship between brooding rumination and maternal attunement.

Note: IBQr-NA = Negative affect subscale of the Infant Behaviour Questionnaire revised
CHAPTER 4: A prospective study to investigate the impact of rumination on maternal bonding and mood

4.1 Preface

The primary aim of this chapter is to test the hypothesis that rumination prospectively predicts impairments in maternal attunement in the context of maternal depressive symptoms (thesis hypothesis 2, Figure 4.1). The study reported in the main section of this chapter builds on the results reported in study 1 which demonstrated that rumination was significantly correlated with maternal attunement, and a small body of existing findings further indicating the potential for a prospective relationship between rumination and attunement in the postnatal period. The paper presented in the main body of this chapter is currently being prepared for submission to the British Journal of Psychiatry.

Figure 4.1:
Hypothesised thesis model: hypotheses 3 and 5
Background

At least one study has demonstrated that rumination during pregnancy predicted postpartum bonding in the postnatal period (Müller, Teismann & Havemann et al., 2012) but to the author’s knowledge, no previous studies have examined the prospective relationship between rumination, maternal attunement and depressive symptoms postnatally. The study presented in this chapter (study 2) is therefore a first step in examining the temporal nature of the relationship between rumination, maternal attunement to the infant, and maternal depressive symptoms, thus testing the application of the Response Styles Theory (RST; Nolen-Hoeksema, 1991) in the context of postnatal depressive symptoms and the mother-infant relationship.

More specifically, I hypothesized that higher trait rumination at baseline would predict poorer maternal attunement at the six month follow-up, and that the effect of rumination at baseline on attunement at six months would be moderated by postnatal depressive symptoms at baseline, such that that rumination would predict poorer attunement when depressive symptoms were high, but not when they were low.

Method and results

Study 2 includes a follow up assessment point approximately six months after the baseline assessment that formed the results of study 1, allowing for an examination of the prospective relationship between the primary study variables. A proportion of the original sample did not complete the six month follow-up measures ($N = 65, 30\%$). The demographics, depressive symptoms, rumination and attunement scores of participants who had complete data were not significantly different to those who did not complete the follow up assessment, with the exception of age, providing some evidence that data were missing at random (section 4.9, Appendix B).
Multiple imputation is recommended as an appropriate method for handling missing data that is missing at random (MAR), and so NORM for windows version 2 (Schafer, 1999) was employed in this study to impute missing values. The measures for attunement (as assessed by maternal responsiveness and maternal bonding), rumination and depressive symptoms were positively skewed at both baseline and follow up. Log transformations were used to normalise these variables prior to multiple imputation (section 4.8, Appendix A).

The main analyses reported in study 2 are a series of cross-sectional and prospective Hierarchical Linear Regression models to explore whether the interactive effects of depressive symptoms, as assessed using the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden and Sagovsky, 1987) and rumination, assessed using the Response Styles Questionnaire-revised (RRS; Nolen-Hoeksema and Morrow, 1991; Treynor et al., 2003) on attunement, assessed using the Postpartum Bonding Questionnaire (PBQ; Brockington et al., 2001) differed when observed concurrently versus across time. In both the cross-sectional and prospective analyses, baseline depressive symptoms and baseline rumination (and their interaction term) were the dependent variables, and attunement at the six month follow up was the criterion variable. Significant interactions were explicated using simple slopes analyses (Aiken and West, 1991), treating maternal depressive symptoms as the moderator. Appendix C (section 4.10) also presents supplementary analyses exploring the prospective relationship between rumination, maternal depressive symptoms and maternal responsiveness.

The results presented in study 2 are partially consistent with the stated hypotheses. As predicted, there was both a concurrent and prospective relationship between rumination and attunement, and this relationship was moderated by maternal depressive symptoms. However, contrary to predictions, rumination did not
prospectively predict maternal attunement. Instead, poorer maternal attunement at baseline predicted increased rumination at the follow up. Further, in partial support of the hypotheses, depressive symptoms moderated this relationship. However, contrary to expectations, there was a significant relationship between maternal attunement at baseline, and subsequent rumination when depression scores were low, instead of high. This finding is of interest, because it highlights a potential role for the Goal Theory of rumination in the postnatal period, suggesting that impairments in bonding may result in a greater tendency to ruminate in mothers who are not experiencing depressed mood.
4.2 Abstract

Postnatal maternal depressive symptoms are consistently associated with impairments in maternal attunement (i.e. maternal responsiveness and bonding). However, there is little research examining the impact of maternal cognitive factors (e.g. rumination) on maternal attunement and mood, and the prospective relationship between them. This study investigated the hypothesis that increased rumination would prospectively predict poorer maternal attunement, and that depressive symptoms would moderate the effect of rumination on attunement. To test the strength of this association we also examined whether the reverse relationship was true, with maternal attunement examined as a predictor of increased rumination at 6 months. Two hundred and twelve mothers completed measures on rumination, depressive symptoms, and maternal attunement at baseline, and six months later. The data were analysed using Hierarchical Linear Regression. In partial support of the hypotheses, rumination and attunement were prospectively related. However, contrary to predictions a reverse relationship was found in which poorer maternal bonding (but not responsiveness) was predictive of increases in rumination when depressive symptoms were low, not high. These findings suggest a potentially different directional relationship between rumination and attunement than expected, which is broadly consistent with the Goal Theory of rumination, rather than Response Style Theory. This study provides new evidence for the unfolding relationship between maternal attunement with infant, maternal rumination and maternal mood.
4.3 Introduction

Maternal bonding, or the thoughts, feelings and behaviours that are directed to maintain the mother's physical and psychological proximity to the child (Feldmen et al., 1999) is strongly associated with positive child outcomes (Bigelow et al., 2010; Tamis-Lemonda & Bornstein, 2002; Bigelow, MacLean & Proctor, 2004) and inversely related to negative maternal emotional characteristics (e.g., depression; for a review see Field, 2010). Further, there is evidence that bonding mediates the relationship between maternal depression and negative cognitive and behavioural child outcomes (for a review see Grace, Evindar and Stewart, 2003). There is, however, little research examining the specific maternal cognitive factors (e.g. rumination) that are associated with poorer bonding. To date, maternal cognitive factors have largely been studied concurrently and less is understood about the prospective relationships between depressive symptoms and bonding and how specific cognitive processes may impact the mother’s ability to feel close to her infant. This is important because a better understanding of the temporal relationships between specific cognitive processes and maternal bonding with her infant may inform more specific targets for future intervention programmes, and will also help to elucidate the nature of how cognitive factors such as rumination impact on attunement and maternal depression. In this study we examine the impact of maternal rumination on bonding with infant in the context of maternal depressive symptoms.

4.3.1 Rumination and bonding in the context of postnatal depressive symptoms

There is extensive correlational and experimental evidence linking rumination, a repetitive style of thinking that “focuses an individual’s attention on their depressive symptoms and on the implications of these symptoms” (Nolen-Hoeksema, 1991, p569), with the severity and maintenance of depression (Lyubomirsky, Caldwell & Nolen-
Hoeksema, 1998; Lyubomirsky, Kasri, & Zehm, 2003; Noeln-Hoeksema, Larson & Grayson, 1999). Studies have demonstrated that rumination focuses an individual’s attention inwards, rather than outwards towards the environment, and serves to magnify negative stimuli (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky et al., 1999; Watkins, 2008). Other recent literature demonstrates rumination to be an avoidant emotion regulation strategy (Watkins and Moulds, 2004; Moulds, et al., 2007). As such, rumination may be an important factor involved in maternal bonding, potentially either engaging the mother in avoidant behaviours, or focusing attention away from the environment and important infant behavioural and emotional cues, and biasing attention towards negative stimuli (Donaldson, Lam and Matthews, 2007).

It is further suggested that negative maternal cognitions (e.g. rumination) may lead to the mother being ‘preoccupied’ and less able to be responsive to the infant’s social and emotional needs (Stein, 2008). In support of this notion, Murray, Kempton, Woolgar and Hooper (1993) found that at three months postpartum, mothers with postnatal depression expressed more negative affect, were less focused on infant experience and tended to show less acknowledgement of infant agency than a control group. Mothers with postnatal depression were also more self-focused when interacting with their infants. Teti and Gelfand, (1997) also speculated that negative maternal cognitions can result in self-absorption, preoccupation and a narrowed field of attention all of which could be implicated in a less than optimal mother-infant relationship.

A small body of research has investigated the association between rumination bonding. In one study, rumination, as assessed with the Postpartum Bonding Questionnaire, was negatively associated with self-reported bonding with the infant at five weeks postpartum (Müller et al., 2012). In a subsequent study, brooding rumination was also negatively related to self-reported maternal responsiveness in infants who were low, but not high, in negative temperament (Tester-Jones et al.,
submitted manuscript). Using an experimental manipulation of rumination, Stein and colleagues (2012) also found that a rumination and worry prime in mothers with Generalized Anxiety Disorder interfered with responsiveness to their 10 month old infants in a play interaction task. A similar trend was observed in mothers with depression.

The Response Styles Theory (RST; Nolen-Hoeksema, 1999) suggests that whilst many people are likely to ruminate at one time or another, there are a subset of individuals who tend to more often respond to feelings of depression or distress with rumination. According to this theory, the way in which individuals typically respond to their depressed mood affects the course and duration of mood. In support of this notion, experimental studies have shown that rumination plays a causal role in the exacerbation of depressive symptoms, including worsening dysphoric mood, increasing negative thinking and impairing interpersonal problem solving (Lyubomirsky & Nolen-Hoeksema, 1995). These studies highlight rumination as a driving mechanism in the onset of depression. This may be because when people ruminate in the context of a dysphoric mood, they recall more negative memories from the past, interpret their current situation more negatively, and are more pessimistic about their future (Lyubomirsky et al., 1998; Lyubomirsky & Nolen-Hoeksema, 1993, 1995). Ruminators also report feeling less supported by friends and family members (Nolen-Hoeksema & Davis, 1999). In parenting situations, rumination may result in a more negative interpretation of past and current interactions with the infant, more pessimism about future interactions and less perceived social support in dealing with these difficulties. Such interpretations of the mother-infant relationship may contribute towards poorer perceived bonding and low maternal mood. Thus, in the present study we hypothesised that higher trait rumination in the context of depressive symptoms would predict poorer bonding (Figure 4.2).
However, it is also possible to think of rumination as a response to environmental discrepancies, or negative events. Goal Theory (Martin, Tesser and McIntosh, 1993) proposes that rumination occurs not as a response to low mood, but as a result of discrepancies in the environment and failure to reach (or make desired progression towards) a goal. This notion may also be relevant in parenting situations. For example, if a mother does not feel as bonded with her infant as she would like to this may be seen as a failure in parenting ability. Rumination in this situation is a way to focus inwards to solve the problem, and may be viewed as a method by which the mother believes she may make progress towards her unattained goal (i.e. improved bonding). While according to this theory rumination may serve as a regulatory function it does not always result in goal progress, or in the goal being relinquished, which could potentially lead to low mood (McIntosh, Gillanders & Rodgers, 2010). As such, it is conceivable that the prospective relationship between rumination and bonding may be bi-directional.

Figure 4.2

Rumination at time 1 (T1) is hypothesised to predict poorer mother-infant bonding at time 2 (T2). This relationship is expected to be exacerbated by depressive symptoms.

Note: Dashed line indicates reverse relationship to be tested
4.3.2 The present study

Consistent with RST, we propose that in the context of depressive symptoms, increased rumination may prospectively impair perceived bonding with infant. Whilst more broadly recent evidence demonstrates a relationship between maternal cognitions and the mother-infant relationship, there is a lack of longitudinal and prospective research examining the temporal relationships between rumination, bonding and depressive symptoms. The present study also sought to test the predictions of the Response Styles Theory and Goal Theory in the context of the postnatal period, and examine the consequences of dysphoric rumination for mother-infant bonding. Specifically, this study examined the prospective relationships between rumination, bonding and maternal mood over a six month period. We hypothesised that concurrently, rumination would be associated with bonding, and depressive symptoms would moderate this relationship. Second, we hypothesised that higher trait rumination at baseline would predict poorer mother-infant bonding at the six month follow-up. However, to test the predictions of the Goal theory of rumination, we also examined whether maternal bonding at baseline was predictive of rumination at six months. Finally, we hypothesised that the effect of rumination at baseline on bonding at six months would be moderated by postnatal depressive symptoms at baseline. We expected that rumination would predict poorer bonding when depressive symptoms were high, but not when they were low. Again, the reverse relationship was also tested, such that depressive symptoms were examined as a moderator of the effect of maternal attunement at baseline on ruminative thinking at 6 months.

4.4 Method

4.4.1 Participants

Data were examined from 212 mothers with infants aged between nine and 14
months who provided data at baseline. This age range was chosen because the mother-infant relationship emerges strongly and reliably during this period (Benoit, 2004). By this age, the infant has come to recognise caregiver responses and shape their own behaviours accordingly (Benoit, 2004). The mean age of mothers at baseline was 31.45 years (SD = 5.25). Infant mean age at baseline was 11.28 months (SD = 1.71). The majority of mothers were of British nationality (90.5%, n = 183) and had received a higher education degree (64.2%, n = 130). The majority (63.2%, n = 128) of mothers were primiparous. Participants were approached both via online advertising on UK mother and baby websites and in community mother and baby groups within local children’s centres in the South West of England.

4.4.2 Measures

*Postpartum Bonding Questionnaire* (PBQ; Brockington et al., 2001). The PBQ assesses a mother’s feelings or attitudes towards her baby (e.g. “I feel close to my baby”, “My baby irritates me”). It has 25 statements, and responses are scores on a six point Likert scale ranging from zero (‘always’) to 5 (‘never’) with higher scores indicating poorer bonding. It has been successfully validated in previous studies (e.g. Brockington et al., 2006) and is comprised of four subscales; Impaired bonding, rejection and anger, infant focused anxiety and incipient abuse. Test-retest reliability was 0.95, 0.95, 0.93 and 0.77 respectively for the four subscales (Brockington et al., 2006; Brockington et al., 2001). Cronbach’s Alpha in this study was .92.

*Depressive symptoms* were assessed with the 10 item Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden and Sagovsky, 1987). The EPDS is a well-established instrument, validated for the screening of depression in the postpartum period. The EPDS measures the mother’s psychological well-being over the past seven
days (e.g. I have looked forward with enjoyment to things) on a Likert scale ranging from zero (No, not at all) to 3 (yes, all the time). It has been successfully validated in a number of studies (e.g. Bergant et al, 1998; Cox et al, 1996) and demonstrated excellent internal consistency in this study ($\alpha = .91$).

*Rumination* was assessed with the Response Styles Questionnaire (Revised; RRS). The RRS assesses participants' tendencies to ruminate in response to their symptoms of negative emotion. This version combines the original 22 item version (Nolen Hoeksema and Morrow, 1991) with the recent version (25 in total on a 4-point Likert scale) by Treynor et al. (2003). Example items include “'I think, 'Why do I react this way?'” and “'I think about how hard it is to concentrate'”. The revised version allows for the assessment of two different components of rumination; reflection and brooding. Scores were calculated for each component. Previous studies reported acceptable convergent and predictive validity for the Ruminative Responses Scale (e.g. Butler & Nolen-Hoeksema, 1994; Nolen-Hoeksema & Morrow, 1991). Cronbach’s alphas were .85 and .82 for the brooding and reflective subscales respectively, and .96 for the total scale.

*Demographics.* Participants were asked to provide information on their age, the age of their infant, how many children they had in total, their nationality and level of education.

4.4.4 *Procedure*

The study was approved by the University of Exeter, School of Psychology ethics committee. All participants completed the study online using Qualtrics survey software and indicated consent prior to taking part. Once consent was given a link was
made available to a questionnaire pack. Completion time was approximately 30 minutes. Questionnaires could be completed in one sitting or over two or more sessions using a save and continue function. Participants were contacted and asked to complete the same questionnaire pack again approximately six months after completing the baseline pack. Participants were initially contacted by telephone to inform them that the six month follow up was approaching, and that they would receive an email with a link to the questionnaire. In the event that participants did not complete the questionnaire, up to three follow up phone calls were made, each with an accompanying email and a new link to the questionnaire. Where possible, non-responsive participants were also contacted by text message, and offered paper copies of the questionnaire with a freepost return envelope if internet access was not possible. After completion, participants received a written debriefing that thanked them for taking part and reminded them of the nature of the study.

4.5 Data analysis

Preliminary data analyses were conducted in PASW statistics, version 18. Data were checked for accuracy, missing data, outliers and normality. Rates of participation decreased at the six month follow up. Of the 212 participants that provided data at baseline, 9 (4%) did not provide complete data. Complete data at six months were achieved for 147 (70%) of the 212 participants. The demographics (age, Nationality, education), depressive symptoms, rumination or attunement scores of participants who had complete data were not significantly different to those with incomplete data, providing supporting evidence that data were missing at random.

We used multiple imputation to handle missing data, which results in less bias than alternative procedures such as list-wise deletion or mean substitution (Howell, 2008). Multiple imputation was implemented using NORM for windows version 2
The PBQ, EPDS and RRS were positively skewed at both baseline and follow up. Log transformations were used to normalise these variables prior to multiple imputation, as recommended by Schafer (1999), and all independent variables were centred prior to conducting the main analyses in order to reduce nonessential multicollinearity. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (EPDS time 1, Tolerance = .38, VIF = 2.57; RRS time 1, Tolerance = .38, VIF = 2.61 RRS time 2, Tolerance = .41, VIF = 2.43; PBQ time 1, Tolerance = .63, VIF = 1.56; PBQ time 2, Tolerance = .26, VIF = 3.72).

Descriptive statistics and bivariate correlations were examined prior to hypothesis testing. Cross-sectional and prospective tests were then run using Hierarchical Linear Regression to explore whether the interactive effects of depressive symptoms and rumination on bonding differed when observed concurrently versus across time. In both the cross-sectional and prospective analyses, T1 depressive symptoms and T1 rumination were the dependent variables. The prospective model then tested the hypothesis that baseline (T1) depressive symptoms and baseline rumination would predict bonding at the six month follow up (T2). An interaction term was then entered to test the hypothesis that T1 depressive symptoms would moderate the relationship between T1 rumination and T2 bonding. Bonding at T1 was entered as a covariate on Step 1 of each regression equation in order to insure that any significant results in predicting T2 bonding could not be accounted for by prior bonding scores. The remaining main effects, T1 depressive symptoms (EPDS) and T1 rumination (RRS) and the interaction term, EPDS x RRS, were entered hierarchically on subsequent steps of the regression analyses. Significant interactions were explicated using simple slopes analyses (Aiken and West, 1991), treating depressive symptoms as the moderator. The models were specified at high (mean – 1 SD) and low (mean + 1 SD) depressive scores. The same procedure was used to test the reverse relationship for both the concurrent and
prospective model (i.e. the lower order and interactive effects of depressive symptoms and bonding on rumination). Where rumination was predicted prospectively at T2, rumination at T1 was entered as a covariate on step 1 of each regression equation.

4.6 Results

4.6.1 Descriptive statistics and bivariate correlations

Pearson correlation analyses were conducted to examine the interrelationship among the main study variables at baseline (T1) and six month follow-up (T2). See Table 4.1 for correlations, means and standard deviations. Consistent with previous literature, all correlations were significant, with those between depressive mood and rumination at T1, and bonding at T1 and T2, being the most substantial ($r > .70$). As predicted, maternal bonding at baseline was significantly correlated with rumination at both T1 and T2, and rumination at T1 was significantly correlated with maternal bonding at T1 and T2.

The relationship between T1 rumination and T2 bonding was then examined using a partial correlation controlling for the effects of T1 bonding and T1 depressive symptoms. The correlation was found to be only marginally significant and very weak ($r(208) = .05, p = .051$). The reverse relationship between T1 bonding and T2 rumination was also subjected to a partial correlation in order to examine the relationship controlling for the effects of T1 rumination and T1 depressive symptoms. There was a statistically significant relationship between T1 bonding and T2 rumination above and beyond the effects of depressive symptoms and rumination at baseline, but this relationship was weaker, $r(209) = .20, p = .004$. Together, these results suggest that the relationship between T1 rumination and T2 bonding is not as strong as that between T1 bonding and T2 rumination.
Table 4.1

Pearson correlations and summary of means and standard deviations of the measured variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EPDS T1</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.86</td>
<td>5.96</td>
</tr>
<tr>
<td>2 RRS T1</td>
<td>.75**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.21</td>
<td>16.66</td>
</tr>
<tr>
<td>3 PBQ T1</td>
<td>.53**</td>
<td>.47**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>35.66</td>
<td>12.23</td>
</tr>
<tr>
<td>4 EPDS T2</td>
<td>.39**</td>
<td>.45**</td>
<td>.16*</td>
<td>--</td>
<td></td>
<td></td>
<td>7.875.63</td>
<td></td>
</tr>
<tr>
<td>5 RRS T2</td>
<td>.55**</td>
<td>.57**</td>
<td>.45**</td>
<td>.65**</td>
<td>--</td>
<td></td>
<td>42.20</td>
<td>14.77</td>
</tr>
<tr>
<td>6 PBQ T2</td>
<td>.15*</td>
<td>.20**</td>
<td>.76**</td>
<td>.25*</td>
<td>.40**</td>
<td>--</td>
<td>40.40</td>
<td>8.46</td>
</tr>
</tbody>
</table>

Notes: *p < .05, **p < .01, ***p < .001; EPDS = Edinburgh Postnatal Depression Scale; RRS = Ruminative Response Scale – revised; PBQ = Postpartum Bonding Questionnaire; T1 = Time 1, baseline assessment; T2 = Time 2, six month follow up assessment
4.6.2 Do depressive symptoms moderate the concurrent relationship between bonding and rumination?

To test the first hypothesis that concurrently, rumination would be associated with bonding, and depressive symptoms would moderate this relationship, multiple regression was used to examine the simultaneous effects of depressive symptoms and rumination, and their interaction effects, on bonding (Table 4.2). Both T1 depressive symptoms and T1 rumination were associated with T1 bonding and the interaction between T1 depressive symptoms and T1 rumination was also significantly associated with T1 bonding. In the first step, T1 depressive symptoms accounted for 27% ($F (1, 211) = 81.18, p < .001$) of the variability in bonding scores, as indexed by the adjusted $R^2$ statistic. In this step, depressive symptoms were a significant predictor of T1 bonding. In the second step, when T1 rumination was added to the model, the two predictors together accounted for 29% , $F (2, 211) = 43.21, p < .001$, of the variability in T1 bonding scores and the change in variability in the second step was .014, $F (1, 209) = 4.05, p = .04$. In this step, both T1 depressive symptoms and T1 rumination were significant predictors of bonding. We then examined the conditional effects of T1 rumination on T1 bonding at high and low levels of T1 depressive symptoms. T1 rumination was a significant, positive predictor of T1 bonding when conditioned on high levels of depressive symptoms at T1 ($\beta = .27, SE = .09, p = .002$).
Table 4.2

Concurrent moderated regression analyses predicting (a) T1 rumination and (b) T1 maternal bonding with infant

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Predictors</th>
<th>β</th>
<th>SE β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) RRS T1</td>
<td>EPDS-T1</td>
<td>.76</td>
<td>.06</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>PBQ-T1</td>
<td>.16</td>
<td>.06</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>EPDS-T1 x PBQ-T1</td>
<td>.99</td>
<td>.35</td>
<td>.006</td>
</tr>
<tr>
<td>b) PBQ T1</td>
<td>EPDS T1</td>
<td>.40</td>
<td>.09</td>
<td>&lt; .001</td>
</tr>
<tr>
<td></td>
<td>RRS T1</td>
<td>.17</td>
<td>.08</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>EPDS-T1 x RRS T1</td>
<td>1.285</td>
<td>.42</td>
<td>.002</td>
</tr>
</tbody>
</table>

Notes: EPDS = Edinburgh Postnatal Depression Scale; RRS = Ruminative Response Scale – revised; PBQ = Postpartum Bonding Questionnaire; T1 = Time 1, baseline assessment; T2 = Time 2, six month follow up assessment
A reverse relationship was also tested wherein the lower order and interactive effects of depressive symptoms and bonding on rumination were examined cross-sectionally (Table 4.2). Lower order effects of T1 depressive symptoms and T1 bonding were consistent with bivariate associations. In the first step, T1 depressive symptoms accounted for 56% \( F (1, 211) = 274.16, p < .001 \) of the variability in rumination scores, as indexed by the adjusted \( R^2 \) statistic. In this step, depressive symptoms were a significant predictor of T1 rumination. In the second step, when T1 bonding was added to the model, the two predictors together accounted for 57%, \( F (2, 211) = 43.21, p < .001 \) of the variability in bonding scores and the change in variability in the second step was .008, \( F (1, 209) = 4.05, p = .04 \). In this step, both T1 depressive symptoms and T1 bonding were significant predictors of rumination. The interaction between T1 depressive symptoms and T1 bonding was also a statistically significant predictor of T1 rumination. Figure 4.3 presents the simple slopes for the concurrent association between bonding and rumination.

**Figure 4.3**

Simple slopes for the concurrent association between maternal bonding (PBQ) and rumination (RRS) at high (mean - 1 SD) and low (mean + 1 SD) levels of depressive symptoms (EPDS). Higher PBQ scores denote poorer maternal bonding with infant.
4.6.3 Is there a prospective relationship between bonding, rumination and depressive symptoms?

To test the second and third hypotheses, multiple regression was performed to examine the effects of T1 depressive symptoms and T1 rumination on T2 bonding. In this model, T2 bonding was the dependent variable, with T1 depressive symptoms and T1 rumination as the predictors. Depressive symptoms at T1 were a significant predictor of bonding at T2, accounting for 66% ($F(3, 211) = 137.82, p < .001$) of the variability in bonding at T2, as indexed by the adjusted $R^2$ statistic. However, consistent with the first order partial correlations, rumination at T1 was not a significant predictor of bonding at T2 when depressive symptoms at T1 were held constant (Table 4.3). The interaction between T1 depressive symptoms and T1 rumination was not a significant predictor of bonding at T2.

To test the reverse of the prospective relationship between rumination and bonding, T2 rumination was entered as the dependent variable with T1 depressive symptoms and T1 bonding as predictors in order to determine if T2 rumination could be predicted as a function of depressive symptoms and maternal bonding at T1. In the first step, T1 depressive symptoms accounted for 37% ($F(2, 211) = 60.89, p < .001$) of the variability in rumination scores, as indexed by the adjusted $R^2$ statistic. In this step, depressive symptoms were a significant predictor of T1 rumination. In the second step, when T1 bonding was added to the model, the two predictors together accounted for 44%, $F(3, 211) = 56.91, p < .001$, of the variability in bonding scores and the change in variability in the second step was .08, $F(1, 208) = 31.30, p < .001$. In this step, T1 depressive symptoms were only a marginally significant predictor of T2 rumination, and T1 bonding was a significant predictor of T2 rumination (Table 4.3).

Next, we tested the interactive effects of T1 depressive symptoms and T1 bonding on T2 rumination. The interaction term was significant and we examined the
conditional effects of T1 bonding on T2 rumination at high and low levels of T1 depressive symptoms. Contrary to our hypothesis, T1 bonding was a significant, positive predictor of T2 rumination when depressive symptoms at T1 were low ($\beta = .29$, $SE = .15$, $p = .05$). However, when depressive symptoms were high, T1 bonding did not significantly predict T2 rumination ($\beta = -.06$, $SE = .11$, $p = .57$). Figure 4.4 presents the simple slopes for the prospective association between bonding and rumination. Together these findings suggest that bonding at T1 predicts rumination at T2, and depressive symptoms at T1 moderate this relationship, but these findings fail to demonstrate that rumination prospectively predicted bonding\(^1\).

Figure 4.4

Simple slopes for the prospective association between maternal bonding (PBQ) and rumination (RRS) at high (mean - 1 SD) and low (mean + 1 SD) levels of depressive symptoms (EPDS). Higher PBQ scores denote poorer maternal bonding with infant.

---

\(^1\) The pattern of results for all analyses were very similar when the RRS Brooding subscale was entered instead of the full RRS, with the exception of the first-order partial correlation to explore the relationship between T1 bonding and T2 rumination controlling for the effects of T1 rumination and T1 depressive symptoms. This correlation was not statistically significant, $r(208) = .09$, $p = .19$
**Table 4.3**

Prospective moderated regression analysis predicting (a) T2 rumination and (b) T2 maternal bonding with infant

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Predictors</th>
<th>β</th>
<th>SE β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) RRS T2</td>
<td>EPDS-T1</td>
<td>.19</td>
<td>.10</td>
<td>.054</td>
</tr>
<tr>
<td></td>
<td>PBQ-T1</td>
<td>.21</td>
<td>.07</td>
<td>.004</td>
</tr>
<tr>
<td></td>
<td>EPDS-T1 x PBQ-T1</td>
<td>-1.09</td>
<td>.46</td>
<td>.018</td>
</tr>
<tr>
<td>b) PBQ T2</td>
<td>EPDS T1</td>
<td>-.48</td>
<td>.09</td>
<td>&lt; .001</td>
</tr>
<tr>
<td></td>
<td>RRS T1</td>
<td>.05</td>
<td>.07</td>
<td>.51</td>
</tr>
<tr>
<td></td>
<td>EPDS-T1 x RRS T1</td>
<td>-.58</td>
<td>.37</td>
<td>.16</td>
</tr>
</tbody>
</table>

EPDS; Edinburgh Postnatal Depression Scale, RRS; Ruminative Response Scale - revised, PBQ; Postpartum Bonding Questionnaire; T1; Time 1, baseline assessment; T2, Time 2, six month follow up assessment
4.7 Discussion

This study demonstrated that rumination is both concurrently and prospectively related to maternal bonding with infant, and that this relationship is moderated by depressive symptoms. Consistent with our first hypothesis, a concurrent, bidirectional relationship was found between rumination, maternal bonding and depressive symptoms. However, support for our second hypothesis, that T1 rumination would prospectively predict maternal bonding at T2, was not found. Instead, maternal bonding at baseline prospectively predicted rumination at the six month follow up. This suggests that the prospective relationship between maternal bonding and rumination in this sample is unidirectional. Also in contrast to our predictions, the prospective relationship between maternal bonding and rumination was significant when depressive symptoms were low, but not high.

The results supporting hypothesis 1 replicate and extend previous findings on the relationship between maternal bonding, rumination and mood. For example, Barnum, Woody and Gibb (2012) found that brooding rumination was predictive of depressive symptoms changes from pregnancy to two months postpartum, and recently research has shown that rumination mediates the concurrent relationship between depressive symptoms and how well a mother responds to her infant in the postpartum period (Tester-Jones et al., submitted manuscript). Similarly, in this study we found a significant association between rumination and maternal bonding in the postnatal period. Moreover, depressive symptoms were found to moderate this relationship; concurrently, rumination had a significant, positive relationship with bonding when depressive symptoms were high, but not low.
4.7.1 Maternal bonding prospectively predicts ruminative thinking; Implications for Response Styles Theory

An unexpected pattern of results was found with respect to the prospective relationships between rumination and maternal bonding. This finding highlights a potentially different temporal relationship between rumination and bonding than originally expected. While this is preliminary data with self-report measures, it suggests that rumination may not result in impaired bonding, but instead occurs as a result of poorer perceived bonding with infant. In further support of this notion, an examination of the partial correlations revealed that the prospective relationship between rumination at T2 and bonding at T1 was stronger than the relationship between depression at T1 and rumination at T2.

It is of note however, that these findings are in contrast with existing literature around rumination in the perinatal period. Previous literature has demonstrated that a woman’s emotional state and rumination during pregnancy is predictive of how bonded she feels with her infant in the postpartum period. For example, ruminative thinking during pregnancy was found to be a predictor of self-reported bonding with infant at five weeks postpartum (Müller et al., 2012). Interestingly however, Müller and colleagues assessed rumination using the Perseverative Thinking Questionnaire (PTQ; Ehring et al., 2011) which is less focussed on rumination as a response to depressed mood, and more so on repetitiveness of thinking, and difficulty disengaging. The findings of the present study suggest that postnatally, rumination is not predictive of how close a mother feels with her infant, but the use of different assessments of rumination that are less focussed on responses to mood and more on other aspects of rumination, and/or goal discrepancy may produce different results. Furthermore, the inconsistencies between the results of the present study and those obtained by Müller and colleagues may be a result of sample differences.
The results of the present study have implications for the application of the Response Styles Theory of rumination (RST; Nolen-Hoeksema, 1991) in the postnatal period. RST provides a rationale for hypothesizing that rumination may play a role in the impairment of the mother-infant relationship, including worsening dysphoric mood, increasing negative thinking and impairing key cognitive and behavioural mechanisms such as problem solving (e.g. Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999) and avoidance (e.g. Dickson, Ciesla & Reilly, 2012) that are important for a healthy mother-infant relationship. However, the quality of this relationship is influenced by a number of factors, including sensitivity and responsiveness, as well as bonding (Mead, 2004; Markova & Legerstee, 2006; Amankwaa et al., 2007). It is possible that 1) rumination is differentially related to various attributes of the mother infant relationship, and the antecedents and effects of poor bonding (i.e. feelings of closeness with infant) may be different to those of reduced sensitivity and responsiveness, and 2) a Goal Theory explanation of rumination may be more appropriate in the context of the postnatal relationship with infant.

4.7.2 Rumination as a response to impaired bonding

Although research that directly measures the content of postnatal rumination and assesses multiple aspects of the mother-infant relationship is needed to test these explanations, the Goal Theory of rumination (Martin et al., 1993) may inform the direction of the findings in the current study. Rumination has been theorized as a response to environmental discrepancies, or negative events, as opposed to negative mood (Martin, Tesser & McIntosh, 1993). We speculate that a mother who does not feel bonded with her infant may feel there is a discrepancy between her perceived current bond, and the bond she would like to feel with her infant. In this situation, rumination may serve as an apparent method of thinking about and trying to make progress towards
the unattained goal (i.e. improved bonding). In support of this, research into the reasons why people ruminate identifies solving problems and preventing future mistakes as well as increasing awareness and understanding as being the most frequently reported benefits (Watkins & Baracaia, 2001).

In further support of this notion, the present study demonstrated that maternal bonding was predictive of rumination when depressive symptoms were low, but not high. When depressive symptoms were high, perceived bonding was not predictive of ruminative thinking. However, when depressive symptoms were low, but bonding was perceived to be poor, more rumination was reported at follow up, compared to when bonding was perceived to be good. One possible explanation for this finding could be that at the six month follow up, depressed mood is primarily driving rumination, whereas for individuals low in depressed mood, a goal discrepancy may be the driving it. However, because this study did not measure the content of rumination, this is not possible to confirm. This finding suggests that impairments in bonding can result in increases in rumination in the absence of depressed mood. This has potentially important implications for mothers who are not experiencing depressive symptoms, but are struggling to feel close to their infant. McIntosh, Gillanders and Rodgers (2010) posit that when rumination does not result in goal progress, or in the goal being relinquished, it can result in lower mood. Future research should examine whether increased rumination as a result of impaired bonding leads to the development of depressive symptoms.

4.7.3 Limitations

Some limitations of this study suggest that interpretation of findings should be conducted with care. First, this study design included only two time points and was based on self-report methods which are vulnerable to potential inaccuracies or biased...
responses, with no manipulation of key variables. As such, it is not possible to draw conclusions about the causal role of either rumination or maternal bonding in this study. However, it is notable that to the authors’ knowledge this is the first study to examine the impact of rumination on bonding exclusively in the postnatal period, and provides an important step in examining the directional and causal relationships between rumination and the mother-infant relationship.

Second, this study did not assess the content of ruminative thinking. In order to more effectively unpack the temporal relationships between rumination and bonding, and to draw conclusions about the role of rumination it will be important in future research to assess whether the mother is ruminating about the infant, or other matters. This study also assessed rumination using the Response Styles questionnaire (Nolen-Hoeksema & Morrow, 1991; Treynor et al., 2003), based on RST. An alternative measure of rumination that assesses goal focussed ruminative thought will also be useful in future studies. Future research should also consider using a number of different assessments of mother-infant relationship quality in order to pick up on the multiple aspects of the relationship.

Third, it is also important to note that the EPDS and the RRS were highly correlated at T1 in this study (Table 4.1). This raises questions as to the independence of these variables from one another. Whilst research has demonstrated that rumination and depressive symptoms are independent of one another, (e.g. Roberts, Gilboa, & Gotlib, 1998) this high correlation suggests that it is necessary to be cautious when interpreting the results due to the potential difficulties caused by collinearity (i.e. an increased risk of type I and type II errors, see section 3.7.3). However, it is notable that tests indicated that the data met the assumptions of collinearity in this study.

A final limitation of this study is the lack of diversity in the sample. Future studies should aim to replicate these results with a broader sample of mothers from
different cultural and socioeconomic backgrounds, and to identify a wider sample of women who meet criteria for postnatal depression. It is recognised that the relationships between bonding, rumination and mood may differ in mothers diagnosed with postnatal depression. Given the potential clinical applications of understanding the impact of impaired bonding on ruminative thinking and maternal mood, it will be important for future research to examine whether these relationships differ with a clinically depressed sample of mothers in the postnatal period.

4.7.4 Conclusions

In conclusion, this study has demonstrated a novel and unexpected relationship between rumination, maternal bonding and depressive symptoms. Specifically, poorer maternal bonding at baseline predicted increases in rumination at a six month follow up when depressive symptoms were low, but not high. However, this study failed to demonstrate that rumination at baseline predicts impairments in bonding at the six month follow up. These findings are noteworthy because they provide initial evidence to suggest that in the postnatal period, rumination occurs in response to perceived difficulties in feeling bonded with infant, rather than as a response to negative mood. This is broadly consistent with Goal Theory, although it will be important to assess the content of rumination to confirm this. This study builds on our understanding about how specific cognitive processes such as rumination are temporally related to the mother’s ability to feel close to her infant. Clinically, the results of this study highlight the potential importance of the assessment and prevention of perceived difficulties in the development of the mother-infant relationship in the general postnatal population, as well as in those experiencing depressed mood.
Prior to conducting the main analysis, normality of variable distribution was checked both by investigating skewness and kurtosis, and visually examining the shape of each distribution at each time point. All variables demonstrated skewness ranging from moderate to substantial. The EPDS demonstrated moderate positive skewness at T1, whilst the RRS brooding subscale, PBQ and MIRI all exhibited substantial positive skew at T1 and T2. Log transformations were used to address this issue and normalize each variable. Following transformation, the EPDS, RRS brooding and PBQ were approximately symmetric (Bulmer, 1979) at T1 (Table 4.4), although T1 EPDS, T1 PBQ and T2 RRS brooding were slightly platykurtic. The MIRI remained moderately positively skewed at T1 and the PBQ was still moderately positively skewed at T2 (Figures 4.5 to 4.11).
Table 4.4

Skewness and kurtosis values for study variables at T1 and T2 prior to and after transformation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before transformation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. EPDS T1</td>
<td>.82</td>
<td>.08</td>
</tr>
<tr>
<td>2. RRS T1</td>
<td>.82</td>
<td>-.18</td>
</tr>
<tr>
<td>3. MIRI T1</td>
<td>2.18</td>
<td>6.29</td>
</tr>
<tr>
<td>4. PBQ T1</td>
<td>2.44</td>
<td>7.08</td>
</tr>
<tr>
<td>5. RRS T2</td>
<td>1.02</td>
<td>.86</td>
</tr>
<tr>
<td>6. MIRI T2</td>
<td>1.53</td>
<td>3.81</td>
</tr>
<tr>
<td>7. PBQ T2</td>
<td>2.35</td>
<td>9.92</td>
</tr>
<tr>
<td><strong>After transformation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. EPDS T1</td>
<td>.17</td>
<td>-.67</td>
</tr>
<tr>
<td>2. RRS T1</td>
<td>.50</td>
<td>.08</td>
</tr>
<tr>
<td>3. MIRI T1</td>
<td>.82</td>
<td>.08</td>
</tr>
<tr>
<td>4. PBQ T1</td>
<td>.32</td>
<td>-.75</td>
</tr>
<tr>
<td>5. RRS T2</td>
<td>.48</td>
<td>-.54</td>
</tr>
<tr>
<td>6. MIRI T2</td>
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<td>.41</td>
</tr>
<tr>
<td>7. PBQ T2</td>
<td>.57</td>
<td>1.68</td>
</tr>
</tbody>
</table>

Note: EPDS = Edinburgh postnatal depression scale; RRS = Ruminative Response scale, MIRI = Maternal Infant Responsiveness Instrument, PBQ = Postpartum Bonding Questionnaire; T1 = time 1, baseline assessment; T2 = time 2, 6 month follow up
Figure 4.5

Distribution of maternal depressive symptoms (EPDS) at T1 before (left) and after (right) Log transformation

Figure 4.6

Distribution of rumination (RRS) at T1 before (left) and after (right) Log transformation
Figure 4.7
Distribution of maternal responsiveness (MIRI) at T1 before (left) and after (right) Log transformation

Figure 4.8
Distribution of maternal bonding (PBQ) at T1 before (left) and after (right) Log transformation
**Figure 4.9**

Distribution of rumination (RRS) at T2 before (left) and after (right) Log transformation

![Graph showing distribution of rumination (RRS) at T2 before and after Log transformation.](image)

**Figure 4.10**

Distribution of maternal responsiveness (MIRI) at T2 before (left) and after (right) Log transformation

![Graph showing distribution of maternal responsiveness (MIRI) at T2 before and after Log transformation.](image)
Figure 4.11
Distribution of maternal bonding (PBQ) at T2 before (left) and after (right) Log transformation
4.9 Appendix B: Comparison of participants with and without missing data at T2

A proportion of the original sample did not complete the six month follow-up measures (N = 65, 30%). Tests of simple main effects for group comparisons were conducted to examine any potential differences in those participants who completed both assessments and those who completed the baseline assessment only. Depressive symptoms, rumination and bonding scores of participants who had complete data were not significantly different to those who did not complete the follow up assessment, providing some evidence that data were missing at random (Table 4.5). Age was the exception, with participants who provided complete data being significantly older than those who only provided data at baseline. Because study completers and non-completers were not found to differ on key study variables at baseline, multiple imputation was deemed an appropriate method for handling missing data in this study.
Table 4.5

Comparison (SD) of study completers and non-completers on key study variables and age

<table>
<thead>
<tr>
<th>Measure</th>
<th>No missing data</th>
<th>Missing data at T2</th>
<th>F(df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPDS T1</td>
<td>8.86 (5.96)</td>
<td>9.05 (5.90)</td>
<td>.23 (1, 201)</td>
<td>.63</td>
</tr>
<tr>
<td>RRS T1</td>
<td>9.71 (3.64)</td>
<td>9.20 (3.35)</td>
<td>1.55 (1, 211)</td>
<td>.22</td>
</tr>
<tr>
<td>PBQ T1</td>
<td>34.86 (10.07)</td>
<td>37.54 (15.44)</td>
<td>1.00 (1, 211)</td>
<td>.32</td>
</tr>
<tr>
<td>Age</td>
<td>32.48 (4.70)</td>
<td>30.06 (5.91)</td>
<td>10.58 (1, 211)</td>
<td>.001</td>
</tr>
</tbody>
</table>

Notes: EPDS = Edinburgh Postnatal Depression Scale; RRS brooding = Ruminative Response Scale – brooding subscale; PBQ = Postpartum Bonding Questionnaire; T1 = time 1, baseline assessment
Appendix C: Supplementary analysis to examine the prospective relationship between rumination, maternal depressive symptoms and maternal responsiveness

Maternal attunement can be viewed as a multidimensional construct (see section 2.2.4 for a discussion). Given that in this study attunement was measured using self-report measures, it was important to examine different attributes of the mother infant relationship using these definitions. Thus, this section presents supplementary analyses exploring the prospective relationship between rumination, maternal depressive symptoms and maternal responsiveness.

Pearson correlation analyses were conducted to examine the interrelationship among the main study variables at baseline (T1) and six month follow-up (T2). See Table 4.6 for correlations, means and standard deviations. The relationship between T1 rumination and T2 responsiveness was then explored using a first order partial correlation controlling for the effects of T1 responsiveness and T1 depressive symptoms. The first order correlation was significant, \( r(208) = -.15, p = .02 \) indicating that a relationship between T1 rumination and T2 responsiveness exists above and beyond the effects of depressive symptoms and responsiveness at baseline. The reverse relationship between T1 responsiveness and T2 rumination was also subjected to a first-order partial correlation in order to explore the relationship controlling for the effects of T1 rumination and T1 depressive symptoms. The first-order correlation was not significant, \( r(209) = -.005, p = .94 \).
Table 4.6

Pearson correlations and summary of means and standard deviations of the measured variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EPDS T1</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.86</td>
<td>5.96</td>
</tr>
<tr>
<td>2 RRS T1</td>
<td>.75**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.21</td>
<td>16.66</td>
</tr>
<tr>
<td>3 PBQ T1</td>
<td>.53**</td>
<td>.47**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35.66</td>
<td>12.23</td>
</tr>
<tr>
<td>4 MIRI T1</td>
<td>.44**</td>
<td>.39**</td>
<td>.56**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30.49</td>
<td>8.06</td>
</tr>
<tr>
<td>5 EPDS T2</td>
<td>.39**</td>
<td>.45**</td>
<td>.16*</td>
<td>.13</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>18.05</td>
<td>5.98</td>
</tr>
<tr>
<td>6 RRS T2</td>
<td>.55**</td>
<td>.57**</td>
<td>.45**</td>
<td>.26**</td>
<td>.65**</td>
<td>--</td>
<td></td>
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<td>42.20</td>
<td>14.77</td>
</tr>
<tr>
<td>7 PBQ T2</td>
<td>.15*</td>
<td>.20**</td>
<td>.76**</td>
<td>.23**</td>
<td>.25*</td>
<td>.40**</td>
<td>--</td>
<td></td>
<td>40.40</td>
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<tr>
<td>8 MIRI T2</td>
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<td>.35**</td>
<td>.35**</td>
<td>--</td>
<td>31.71</td>
<td>7.65</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

EPDS = Edinburgh Postnatal Depression Scale; RRS = Ruminative Response Scale – revised; PBQ = Postpartum Bonding Questionnaire; MIRI = Maternal-Infant Responsiveness Instrument; T1 = Time 1, baseline assessment; T2 = Time 2, six month follow up assessment
Do depressive symptoms moderate the concurrent relationship between responsiveness and rumination?

Next, we examined the effects of depressive symptoms and rumination on responsiveness (Table 4.7). When entered together, the EPDS, but not the RRS was a significant predictor of responsiveness. The EPDS accounted for 19% ($F(211) = 49.77$, $p < .001$) of the variability in responsiveness scores, as indexed by the adjusted $R^2$ statistic. The interaction between T1 depressive symptoms and T1 rumination was also significantly associated with T1 responsiveness. We examined the conditional effects of T1 rumination on T1 responsiveness at high and low levels of T1 depressive symptoms. T1 rumination was a significant, positive predictor of T1 responsiveness when conditioned on high levels of depressive symptoms at T1 ($\beta = .15$, SE = .07, $p = .03$), but not when conditioned on low levels ($\beta = -.04$, SE = .09, $p = .67$).
**Table 4.7**

Concurrent moderated regression analyses predicting (a) T1 rumination and (b) T1 maternal responsiveness with infant

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Predictors</th>
<th>β</th>
<th>SEβ</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) RRS T1</td>
<td>EPDS-T1</td>
<td>.79</td>
<td>.06</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>MIRI-T1</td>
<td>.10</td>
<td>.07</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>EPDS-T1 x MIRI-T1</td>
<td>.02</td>
<td>.45</td>
<td>.96</td>
</tr>
<tr>
<td>b) MIRI T1</td>
<td>EPDS T1</td>
<td>.26</td>
<td>.07</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>RRS T1</td>
<td>.09</td>
<td>.07</td>
<td>.15</td>
</tr>
<tr>
<td></td>
<td>EPDS-T1 x RRS T1</td>
<td>.69</td>
<td>.34</td>
<td>.04</td>
</tr>
</tbody>
</table>

EPDS; Edinburgh Postnatal Depression Scale, RRS; Ruminative Response Scale - revised, MIRI; Maternal-Infant Responsiveness Instrument; T1; Time 1, baseline assessment; T2, Time 2, six month follow up assessment
A reverse relationship was also tested wherein the lower order and interactive effects of depressive symptoms and responsiveness on rumination were examined. Lower order effects of T1 depressive symptoms and T1 responsiveness were consistent with bivariate associations. Again, depressive symptoms, but not responsiveness was associated with rumination. In this model, the EPDS accounted for 57% ($F_{(211)} = 138.76, p < .001$) of the variability in rumination scores, as indexed by the adjusted $R^2$ statistic. The interaction between T1 depressive symptoms and T1 bonding was not a statistically significant predictor of T1 rumination.

**Figure 4.4**

Simple slopes for the concurrent association between maternal responsiveness (MIRI) and rumination (RRS) at high (mean - 1 SD) and low (mean + 1 SD) levels of depressive symptoms (EPDS). Higher MIRI scores denote poorer perceived maternal responsiveness to infant.
Is there a prospective relationship between responsiveness, rumination and depressive symptoms?

Multiple regression was then used to examine the effects of T1 depressive symptoms and T1 rumination on T2 responsiveness. In this model, T2 responsiveness was the dependent variable, with T1 depressive symptoms and T1 rumination as the predictors. Depressive symptoms at T1 were a significant predictor of responsiveness at T2, accounting for 12% ($F(211) = 137.82, p < .001$) of the variability in responsiveness at T2, as indexed by the adjusted $R^2$ statistic. However, rumination at T1 was not a significant predictor of responsiveness at T2 when depressive symptoms at T1 were held constant and the interaction between T1 depressive symptoms and T1 rumination was not a significant predictor of responsiveness at T2 (Table 4.8).

To test the reverse of the prospective relationship between rumination and responsiveness, T2 rumination was entered as the dependent variable with T1 depressive symptoms and T1 responsiveness as predictors in order to determine if T2 rumination could be predicted as a function of depressive symptoms and maternal bonding at T1. Again, only depressive symptoms at T1 predicted rumination at T2, accounting for 29% ($F(211) = 44.21, p < .001$) of the variability in rumination scores, as indexed by the adjusted $R^2$ statistic. Maternal responsiveness at baseline did not predict rumination scores at the six month follow-up and depressive symptoms did not interact with responsiveness to predict changes in rumination scores.
Table 4.8

Prospective moderated regression analysis predicting (a) T2 rumination and (b) T2 maternal responsiveness to infant

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Predictors</th>
<th>β</th>
<th>SE β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) RRS T2</td>
<td>EPDS-T1</td>
<td>.62</td>
<td>.07</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>a) RRS T2</td>
<td>MIRI-T1</td>
<td>.04</td>
<td>.09</td>
<td>.69</td>
</tr>
<tr>
<td>a) RRS T2</td>
<td>EPDS-T1 x MIRI-T1</td>
<td>-.36</td>
<td>.61</td>
<td>.56</td>
</tr>
<tr>
<td>b) MIRI T2</td>
<td>EPDS T1</td>
<td>.33</td>
<td>.07</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>b) MIRI T2</td>
<td>RRS T1</td>
<td>-.09</td>
<td>.06</td>
<td>.12</td>
</tr>
<tr>
<td>b) MIRI T2</td>
<td>EPDS-T1 x RRS T1</td>
<td>.12</td>
<td>.32</td>
<td>.72</td>
</tr>
</tbody>
</table>

EPDS; Edinburgh Postnatal Depression Scale, RRS; Ruminative Response Scale - revised, MIRI; Maternal-Infant Responsiveness Instrument; T1; Time 1, baseline assessment; T2, Time 2, six month follow up assessment
CHAPTER 5: A daily diary study to investigate the impact of rumination on maternal bonding and mood.

5.1 Preface

The study presented in chapter 5 (study 3) further evaluates the thesis hypothesis that there will be a prospective relationship between rumination and maternal attunement. Study 3 builds on Study 1, which presented a model in which rumination mediated the concurrent relationship between maternal mood and maternal attunement, and study 2 which demonstrated that maternal bonding prospectively predicted rumination at six months, after controlling for rumination at baseline. This relationship was moderated by depressive symptoms at baseline; such that mothers who were low in depressive symptoms and had lower bonding at baseline reported higher levels of rumination at 6 months. The results also revealed that a reverse pattern of prediction did not hold; rumination at baseline did not prospectively predict maternal bonding at six months. I also predicted that the correlational and prospective relationships reported in studies 1 and 2 would also be present at a state level. It was considered an important aim of this thesis to explore state, as well as trait relationships because recent work has demonstrated that rumination is an ongoing dynamic process that fluctuates over time (Moberly and Watkins, 2008). Thus, study 3 examines the temporal relationships between rumination, bonding and maternal mood at a state level.

5.1.1 Supplementary literature review

5.1.1.1 Rumination and maternal bonding as dynamic states Research has drawn attention to the importance of understanding rumination as a dynamic process that can
change and fluctuate over time in response to different emotional experiences and everyday events. For example, studies examining the test-retest correlations for the Response Styles Questionnaire (RRS) have produced inconsistent results, with only moderate to poor stability demonstrated in clinically depressed samples (Just & Alloy, 1997; Kasch, Klein, & Lara, 2001). This suggests that rumination can change over time. Other recent research using Ecological Momentary Assessment (EMA) has demonstrated that engagement in ruminative thinking varies from moment to moment over the course of a day, and that rumination as a momentary behaviour exhibits a reciprocal relationship with negative affect (Moberly & Watkins, 2008). Thus, rumination can be characterised as both a trait like characteristic and a state like behaviour that is influenced by context, fluctuating with negative affect over time.

Moreover, research also indicates that maternal perceptions of the mother-infant relationship are not always stable, and can demonstrate variability from pregnancy and through the first year postpartum. Stern (1991) posits that maternal representations of the mother-infant relationship begin during pregnancy, but can change and elaborate following birth, as the mother adjusts her expectations. Crucially, Stern also argued that how a mother perceives her relationship with her child is interactive, and is affected by the infant’s behaviours. Whilst there is some evidence that such representations of the mother-infant relationship can be relatively consistent over the course of the first postnatal year (e.g. Benoit et al., 1997; Zeanah et al., 1994), more recent research has revealed that single parenthood, lower income and depressive symptoms are particular indicators of change in a mother’s perception of her relationship with her infant from the third trimester of pregnancy to one year postpartum (Theran et al., 2005). It is suggested that how a mother perceives her infant and her relationship with her infant is open to change across time, and may be
affected not only by infant behaviours, but also personal circumstance and negative affect. It is therefore critical to examine both rumination and maternal attunement as states that vary in everyday contexts and settings, and in response to real emotional experiences between mother and infant that occur day by day. As such, the concurrent and prospective relationships reported in studies 1 and 2 were further examined in a daily diary study (study 3).

5.1.1.2 The function of rumination in the postnatal period

Theories of rumination propose differences regarding its role. The main thesis hypotheses are largely based on the Response Styles Theory (RST; Nolen-Hoeksema, 1991), which suggests that whilst many people are likely to ruminate at one time or another, there are a subset of individuals who tend to more often respond to feelings of depression or distress with rumination. According to this theory, the way in which individuals typically respond to their depressed mood affects the course and duration of mood. When people ruminate in the context of a dysphoric mood, they recall more negative memories from the past, interpret their current situation more negatively, and are more pessimistic about their future (Lyubomirsky et al., 1998; Lyubomirsky & Nolen-Hoeksema, 1993, 1995). Ruminators also report feeling less supported by friends and family members (Nolen-Hoeksema & Davis, 1999). In parenting situations, rumination may result in a more negative interpretation of past and current interactions with the infant, more pessimism about future interactions and less perceived social support in dealing with these difficulties. Such interpretations of the mother-infant relationship may contribute towards poorer perceived bonding and low maternal mood.
However, study 2 demonstrated the reverse pattern of results, which is more suggestive of the Goal Theory framework of rumination. According to Goal Theory, rumination occurs as a response to environmental discrepancies, or negative events. This definition proposes rumination not as a reaction to mood per se, but instead a response to discrepancies in the environment and failure to reach a goal. This notion may be particularly salient in the mother-infant relationship. If a mother does not feel as bonded with her infant as she would like to this may be seen as a failure in parenting ability. The rumination in this situation is viewed as a method by which the mother believes she may make progress towards her unattained goal (i.e. improved bonding). However, McIntosh, Gillanders & Rodgers (2010) note that while according to this theory rumination may serve as a regulatory function it does not always result in goal progress, or in the goal being relinquished, which could potentially lead to low mood. This hypothesis is supported in the adult rumination literature (e.g. Koole, Smeets & Van Knippenberg et al., 1999) and by recent results which demonstrate that poorer bonding at baseline prospectively predicts increased rumination at a six month follow up, and that this relationship is moderated by depressive symptoms at baseline (Tester-Jones et al., unpublished manuscript). However, there is also considerable support for the Response Styles theory of rumination, which posits rumination primarily as a maladaptive response to depressed or negative mood (RST; Nolen-Hoeksema, 1991). Therefore, as in study 2, the current study also tested the hypothesised non-dispositional relationships in the reverse direction to examine the application of Goal Theory in this context (Figure 5.1). Specifically, study 3 hypothesised that a) state perceived bonding with infant on day 1 would prospectively predict state maternal mood and state ruminative self-focus on day 2, and b) the effect of perceived state bonding on state maternal mood would be mediated by state rumination on day 2. The main
body of this chapter consists of a paper summarizing the study findings which is currently being prepared for submission to the Journal of Abnormal Psychology.

_Figure 5.1:_

Hypothesised thesis model: hypothesis 5

![Diagram](image)

This is the first study I am aware of that has examined the state level, non-dispositional relationships between bonding, rumination and mood in mothers in the postnatal period. Previous research provides some precedent for suggesting that perceptions of bonding may change in a state like way (e.g. Stern 1991; Theran et al., 2005). Further, it may be beneficial to view bonding as something that is both trait and state in nature, as the day to day fluctuations in perceived the mother-infant relationship may play a key role in shaping overall trait bonding.
5.1.2 Method and results

The data presented in study 3 exhibited a nested structure; in the dataset, days were nested within persons, so the main analyses reported in study 3 are a series of hierarchical linear models (HLM) used to test for prospective mediation using the Baron and Kenny (1986) steps and recommendations by Kenny, Korchmaros and Bolger (2003) for estimating lower level mediational models in HLM (where all relationships are measured at the day level rather than the person level). Multilevel modelling has several advantages over traditional models for such data. Multilevel modelling can be used to examine the effects of Level 2 and Level 1 variables simultaneously in nested datasets. Multilevel models therefore take into account and adjust for any bias in standard errors and statistical tests resulting from the nonindependence of observations (Krull & MacKinnon, 2001; Kenny, Korchmaros and Bolger, 2003). Unlike traditional models for repeated measures data, multilevel models can also effectively manage unequal group sizes and missing data.

In this study, state rumination was assessed using an adaptation of a measure of rumination used by Moberly and Watkins (2008) which aimed to assess key elements of a ruminative, self-focussed thinking style with three items. Maternal mood and perceived bonding were assessed using a single item, 10 point Likert scale for each. Aggregated measures of rumination and maternal mood across diary days were positively skewed, and perceived bonding was negatively skewed. To address this issue, log transformations were used to normalise the variables (section 5.7, Appendix A). A supplementary analysis was also conducted to explore whether dispositional rumination and bonding, and depressive symptoms were moderators of the state relationships between rumination and bonding reported in the main section of this chapter (section 5.9, Appendix C). The results presented in chapter 5 were consistent with those reported in chapters 3 and 4. As predicted,
perceived bonding with infant on day one prospectively predicted self-reported maternal mood on day two, and this relationship was mediated by ruminative thinking on day 2. In contrast, these results did not demonstrate that rumination impacted on bonding. These findings highlight a consistency in the way both trait and state relationships between maternal bonding, mood and rumination unfold in community samples.
5.2 Abstract

There is little research examining the impact of maternal cognitive factors (e.g. rumination) on maternal bonding and mood. This study investigated the hypothesis that rumination is either a driving mechanism behind poor bonding and mood, or occurs in response to difficulties in relating to the infant. Ninety four mothers completed a ten day diary study investigating the relationship between state ruminative self-focus, negative affect and maternal bonding. The data were analysed using Hierarchical Linear Modelling. Scores on questionnaire measures of dispositional mood and rumination were associated with mean levels of state ruminative self-focus and mood over the ten day sampling period. Concurrently, daily mood was positively associated with daily bonding, and this relationship was partially mediated by state ruminative self-focus. Prospectively, state bonding at time 1 was positively associated with state mood at time 2, and this relationship was mediated by state ruminative self-focus at time 2. A reciprocal relationship was not found. These findings provide new evidence for the unfolding relationship between maternal bonding with infant, maternal rumination and maternal mood. The findings support the theory that rumination occurs in response to negative environmental stimuli, but failed to prospectively demonstrate that rumination impacted on bonding.
5.3 Introduction

Maternal bonding, or the thoughts, feelings and behaviours that are directed to maintain the mother's physical and psychological proximity to the child (Feldman et al., 1999) is strongly associated with positive child outcomes (Bigelow et al., 2010; Tamis-Lemonda & Bornstein, 2002; Bigelow, MacLean & Proctor, 2004) and inversely related to negative maternal emotional characteristics (e.g., depression; for a review see Field, 2010). There is evidence that bonding mediates the relationship between maternal depression and negative cognitive and behavioural child outcomes (for a review see Grace, Evindar & Stewart, 2003). There is, however, little research examining specific maternal cognitive factors (e.g. rumination) that are associated with poorer bonding. To date, maternal cognitive factors have been studied using methodologies such as longitudinal assessment of measures, surveys across community and social contexts, and laboratory observations of mother-infant interactions. However, there has been little examination of the role of cognitive factors in the mother-infant relationship in a natural context. Overall, less is understood about the prospective relationships between depression and bonding and how specific cognitive processes that may impact the mother’s ability to feel close to her infant on a day to day basis.

5.3.1 Rumination and bonding

Negative maternal cognitions (e.g. rumination; a repetitive style of thinking that “focuses an individual’s attention on their depressive symptoms and on the implications of these symptoms”, Nolen-Hoeksema, 1991, p569) may result in self-absorption, preoccupation and a narrowed field of attention (Zhan-Waxler et al, 1990; Teti and
Gelfand, 1997). If the mother is ‘preoccupied’ she may be less able to be responsive to the infant’s social and emotional needs (Stein et al., 2009) resulting in a less than optimal mother-infant relationship. Previous research provides support for this hypothesis. For example, Murray et al. (1993) found that mothers with postnatal depression were more self-focused in their speech when interacting with their infants (e.g. more utterances about the mother herself).

Theories of rumination propose differences regarding its role. Steins’ notion of preoccupation is consistent with the Response Styles Theory (RST; Nolen-Hoeksema, 1991) which holds that rumination may play a role in the exacerbation of depressive symptoms, including worsening dysphoric mood, increasing negative thinking and impairing key cognitive and behavioural mechanisms, such as interpersonal problem solving (e.g. Lyubomirsky and Nolen-Hoeksema, 1995) that are important for sensitive and responsive parenting, thus predicting poorer maternal attunement.

In contrast, the Goal Progress Theory (Martin, Tesser and McIntosh, 1993) proposes that rumination is a response to failure to reach or make progress towards a goal. In a postnatal context rumination may be viewed as a method by which the mother believes she may make progress towards her unattained goal (e.g. improved bonding). Some mothers may find it hard to relate to their baby and rumination may exacerbate this. Encompassing a RST and Goal Theory approach, rumination about difficulties in the mother-infant relationship may serve to trigger, amplify or maintain low maternal mood and reduce both actual and perceived confidence in effective problem-solving needed to resolve infant needs. In the present study we predicted that perceived deficits in bonding would predict both greater levels of rumination and lower mood, and that rumination would mediate the effect of poorer bonding on maternal mood (Figure 5.2).
Rumination has been investigated as a particular maternal cognition that may be related to poorer bonding. Rumination is negatively associated with self-reported bonding with the infant at five weeks postpartum (Müller et al., 2012) and self-reported maternal sensitivity in infants who were low, but not high, in negative temperament (Tester-Jones et al., unpublished manuscript). Stein et al. (2012) also found that a rumination and worry prime in mothers with Generalized Anxiety Disorder interfered with responsiveness to their 10 month old infants in a play interaction task. A similar trend was observed in mothers with depression. However, the temporal relationship between postpartum rumination and maternal bonding has not yet been investigated. Whilst existing findings broadly demonstrate a relationship between postnatal maternal cognitions and the mother-infant relationship, further prospective and experimental designs are required to unpack the specific relationships between rumination and bonding.

*Figure 5.2*

Perceived deficits in bonding at time 1 (T1) are hypothesised to predict lower maternal mood at time 1 (T2). Rumination at T2 is expected to mediate this relationship.
5.3.2 The present study

The present study aimed to investigate the prospective relationships between rumination, bonding and maternal mood at a daily level, and how these relationships occur in real life, every day settings. Studies examining the test-retest correlations for the Response Styles Questionnaire (RRS) have found moderate to poor stability with depressed samples (Just & Alloy, 1997; Kasch, Klein, & Lara, 2001), suggesting that rumination can change over time. Recent research has also demonstrated that ruminative thought is an ongoing dynamic process that fluctuates moment by moment (Moberly and Watkins, 2008). It is therefore critical to examine it in everyday contexts and settings, and in response to real emotional experiences between mother and infant.

Further, Stern (1991) argues that maternal representations of the mother-infant relationship can change and elaborate following birth as the mother adjusts her expectations, and responds to her infant’s behaviours. In support of this, research demonstrates that how a mother perceives her relationship with her infant is open to change in the first postnatal year (Theran et al., 2005). Adult depression literature suggests that rumination can occur in response either to negative mood, or a negative event (such as failure to achieve a desired goal). However it is not yet clear whether at a state level, rumination occurs as a response to perceived difficulties in bonding with infant and plays an active role in the development of dysphoric mood as a result, or whether rumination is a driving mechanism behind poorer bonding and lower maternal mood. The present study therefore tested four hypotheses:
1. Dispositional rumination (RRS) and dispositional bonding (PBQ) will predict mean levels of state rumination and state bonding, independent of depressive symptoms (EPDS) 

2. There will be a negative relationship between state ruminative self-focus and state bonding when measured concurrently, after controlling for state mood.

3. State ruminative self-focus will mediate the concurrent relationship between state bonding and state mood. We will also examine the reverse of this relationship, with state bonding mediating the relationship between state ruminative self-focus and state mood.

4. State bonding will prospectively predict state mood and state ruminative self-focus, when controlling for state mood and state ruminative self-focus at T1. Specifically, we suggest that state bonding with infant on day one will predict state mood on day two, and state ruminative self-focus on day two will mediate the relationship between state bonding and state mood. We will also examine whether a reverse relationship is true, with state rumination on day one predicting state mood on day two, and state bonding on day two mediating the relationship between state ruminative self-focus and state mood.

5.4 Method

5.4.1 Participants

Participants were 93 mothers aged between 18 and 45 ($M = 31.4, SD = 5.9$) with infants aged between 3 and 14 months ($M = 9.2, SD = 3.4$). Participants were recruited both in the South West of England at children’s centres and nationally via email and advertising.
on relevant internet notice boards and forums. Participants who completed the study were entered into a prize draw to win gift vouchers. The majority of mothers were British (99.1%, N = 93), had received a university higher education degree (57.2%, N = 53) and were primiparous (59.9%, N = 56).

5.4.2 Procedure

All participants completed the study online using Qualtrics survey software. Participants were provided with an information sheet about the study which they were asked to read prior to consenting to take part. Once consent was given a link was made available to a questionnaire pack assessing dispositional mood, rumination and maternal bonding. Participants were asked to complete these measures before beginning the diary portion of the study. Completion time of the questionnaire pack was approximately 45 minutes and could be completed in one sitting or over two or more sessions using a save and continue function. After completion of the questionnaire pack, participants were sent a link via email to day one of their state diary questions. Participants completed items related to 3 different states: mood, bonding with the infant and state RSF. State mood and bonding were measured on two separate scales asking the participant to rate their overall mood during the day from 1 (lowest) to 10 (highest) and how close they had felt with their infant during the day on from 1 (not close at all) to 10 (extremely close). The state ruminative self-focus (RSF) scale (adapted from Moberly and Watkins, 2010) asked participants to record their responses to three items; the extent to which they were: focusing on their emotions, focusing on analysing and understanding things, and focusing on evaluating things. Responses were made on a 7 point Likert scale from 1 (not at all) to 7 (very much).
Completion rates were generally good, with participants on average completing 7.98 diaries (total number of missing diaries within the sample = 196 out of 950 days).

Participants were emailed a link to their diary each day, and were asked to respond to the link any time between 3pm and midnight. They were instructed to recall events and feelings from the previous 24 hours only. Participants also received a text message reminder to fill out their diary each evening. Participants were asked to complete the diary every day for 10 consecutive days where possible. Where this was not possible (for example if participants forgot or were too busy), participants were asked to complete 10 diaries during a 14 day period. Following completion of the diary participants received a written debriefing that thanked them for taking part and reminded them of the nature of the study.

5.4.3 Measures

Depressive symptoms were assessed with the 10 item Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987). It demonstrated excellent internal consistency in this study (α = .90).

Dispositional rumination was assessed with the Response Styles Questionnaire (Revised; RRS). The revised version (Treynor et al., 2003) allows for the assessment of two different components of rumination; reflection and brooding. Scores were calculated for each component. Cronbach’s alphas were .86 and .84 for the brooding and reflective subscales respectively.
Mother-infant bonding was assessed with the Postpartum Bonding Questionnaire (PBQ; Brockington et al., 2001). The PBQ is a 25-item scale reflecting a mother’s feelings or attitudes towards her baby (e.g. “I feel close to my baby”, “My baby irritates me”). Low scores denoted good bonding. Cronbach’s alpha in this study was .93.

Demographics. Participants were asked to provide information on their age, the age of their infant, how many children they had in total, their nationality and level of education.

5.4.4 Statistical models

Preliminary data analyses were conducted in PASW statistics, version 18. Data were checked for accuracy, missing data, outliers and normality. Following statistical guidelines in these particular datasets (Roth, 1994), no missing data imputation was performed. The distributions for dispositional mood, brooding and reflective rumination and bonding were positively skewed, as were state mood, bonding and state RSF. Log transformations were used to normalise the variables.

Our data exhibited a nested structure; in this dataset, days (level 1) were nested within persons (level 2), so hierarchical linear modelling (HLM) with MLwiN 2.27 was used to analyse the relationship within and between the levels of structure without violating standard assumptions of independence. Multilevel modelling has several advantages over traditional models for such data. Multilevel modelling can be used to examine the effects of Level 2 and Level 1 variables simultaneously in nested datasets. Multilevel models therefore take into account and adjust for any bias in standard errors and statistical tests resulting from the nonindependence of observations (Krull & MacKinnon, 2001; Kenny,
Korchmaros and Bolger, 2003). Unlike traditional models for repeated measures data, multilevel models can also effectively manage unequal group sizes and missing data.

The analyses were conducted in three stages. Firstly, relationships between state variables and the extent to which ruminative thought and feelings of closeness with infant vary between and within participants were explored. Secondly, models were estimated to investigate whether person-level measures of depressive symptoms (EPDS), bonding (PBQ) and dispositional rumination (RRS) were associated with mean levels of state bonding and state ruminative self-focus (RSF).

Finally, in order to explore the directional nature of the relationships between the three state variables, four mediational models were estimated. Mediation was tested using the Baron and Kenny (1986) steps and recommendations by Kenny, Korchmaros and Bolger (2003) for estimating lower level mediational models in multilevel modelling, where all variables are measured at level 1. This consists of a series of multilevel models to estimate the relations between the predictor (state bonding) and the mediator (state RSF), and the mediator and the outcome variable (state mood) when the predictor is controlled. Two-level models were constructed in which the first subscript, $i$, refers to the diary day, and the second subscript, $j$, refers to the participant. The Level 1 equation for $X$ (state bonding) predicting $Y$ (state mood) without the mediator is:

\[ Y_{ij} = \gamma_{0j} + c_jX_{ij} + e_{ij} (Figure 5.3) \]

In this equation, $Y_{ij}$ (state mood) is the outcome for person $j$ on day $i$, $\gamma_{0j}$ is the random intercept for each person, $c_j$ represents the total effect of $X$ (state bonding) on $Y$ for each
person, and $e_{ij}$ is a day-level error term. The two mediational equations, implied in Figure 1, are:

$$M_{ij} = \gamma_{1j} + a_{j}X_{ij} + e_{ij} \quad (\text{Figure 5.4})$$

and

$$Y_{ij} = \gamma_{2j} + c'_{j}X_{ij} + b_{j}M_{ij} + e_{ij} \quad (\text{Figure 5.5})$$

We refer to path $c$ (from Figure 5.3) as the total effect (direct effect plus indirect effect; $c' + ab$) of $X$ (bonding) on $Y$ (mood), path $c'$ (Figure 5.4) as the direct effect, path $a$ (Figure 2) as the effect of $X$ (bonding) on $M$ (state RSF), and path $b$ (Figure 5.5) as the effect of $M$ (state RSF) on $Y$ (mood). All of these coefficients may vary across participants, which is why they each have the subscript $j$. Kenny et al (2003) recommend that the first step in lower (day) level mediational analysis is to determine if the model is a fully random-effects model (i.e. whether all coefficients do in fact vary significantly across participants). This requires an examination of whether both of the effects in the indirect pathways vary at the participant level. It is suggested by Kenny and colleagues that if at least one of the two effects in the indirect paths is non-random (i.e. fixed) then ordinary mediational analysis procedures that have been used to date can be used to estimate and to test the mediated effects. Comparing overall model fit as assessed by change in log likelihood allows us to determine whether the model will be significantly improved by allowing the variable to vary randomly at the person level. The first set of models explores whether overall,
rumination mediates the relationship between bonding and mood. The second set of models explores this relationship prospectively in order to investigate whether these relationships change over time. Finally, the third set reverses the second set in order to explore whether the relationships between state variables are bidirectional or unidirectional over time.

Based on recommendations by Enders and Tofighi (2007) about centring in multilevel models, level 2 dispositional predictors (EPDS, RRS, PBQ) were centred on their grand means. Level 1 state predictors were also centred on their grand means. Following advice from Wu and Wooldridge (2005), we used theory and our specific research questions to guide our decision to grand mean centre our state (level 1) variables, as we were interested in comparing change to overall group levels of state variables. Further guidance on centring decisions also suggests that grand mean centring is appropriate for the mediational paradigm (Hofmann and Gavin, 1998). For each analysis, separate models were constructed using the full RRS score, and the RRS Brooding and Reflection subscale scores.

5.5 Results

5.5.1 Variability in state ruminative self-focus and state bonding

In order for multilevel modelling to be an appropriate choice of analysis technique, it was first necessary to check whether both state bonding and state RSF would demonstrate some variability across days, rather than just between persons. We used empty multilevel models to confirm this. Consistent with previous findings by Moberly and Watkins (2008), we predicted that there would be some variability in state RSF across days within persons. Furthermore, based on findings that attachment behaviours are stable over time (cite), we
also expected that there would be some consistency in state bonding within persons. However, with state bonding being assessed at an early stage in the mother-infant relationship, both are still learning to recognise responses and shape their own behaviours accordingly. Therefore we did not expect this consistency to be large.

An empty multilevel model partitions the variance at the person and day level without including explanatory variables. The intraclass correlation (ICC) between persons is equivalent to the mean correlation between ratings at two randomly chosen occasions for a particular person (Snijders & Bosker, 1999). This indicates the level of consistency of state RSF and state bonding within persons. The ICC between persons for state RSF was .45, indicating a reasonable level of consistency in state RSF between persons. For the state bonding measure the ICC between persons was .57, again showing reasonable levels of consistency over time. Thus, for both state RSF and state bonding there is also moderate variability within-persons.

5.5.2 Associations between dispositional factors, state bonding and state ruminative self-focus

In the next step, we tested our first hypothesis that depressive symptoms (EPDS), dispositional rumination (RRS) and maternal bonding (PBQ) would be associated with mean levels of state RSF and state bonding. Higher scores on the EPDS were associated with higher levels of state RSF ($b = .32, SE = .06, t (79) = 5.02, p < .001$) but not lower levels of state bonding ($b = -.05, SE = .04, t (68) = -1.25, p = .12$). Higher scores on the RRS total score were associated with higher levels of state RSF ($b = .34, SE = .18, t (78) = 1.88, p = .03$) while controlling for depressive symptoms, as were higher scores on the brooding subscale ($b = .38, SE = .16, t (78) = 2.37, p = .01$). The reflection subscale was
not associated with mean levels of state RSF, and neither the RRS total score, nor the reflection or brooding subscales were associated with mean levels of state bonding when controlling for depressive symptoms (RRS total, $b = -.05, SE = .32, t (66) = -.15, p = .44$; RRS brooding, $b = .25, SE = .28, t (67) = .89, p = .18$; RRS reflective, $b = -.16, SE = .22, t (66) = .72, p = .23$). The PBQ was not significantly associated with mean levels of state RSF ($b = .13, SE = .22, t (78) = .59, p = .27$) or mean levels of state bonding ($b = .08, SE = .38, t (56) = .21, p = .41$) after controlling for depressive symptoms.

5.5.3 Associations between state variables

Next we tested our second hypothesis and expanded the model to explore whether state RSF was associated with state bonding when controlling for state mood. There was a significant effect of state RSF ($b = -.423, SE = .115, p < .001$) indicating that higher levels of state RSF were associated with lower levels of state bonding. These findings indicate that concurrently, there is a relationship between state bonding and state RSF.

5.5.4 Does state RSF mediate the concurrent relationship between state mood and state bonding?

Next, four mediational models were estimated in order to explore the directional nature of the relationships between the three state variables. Multilevel modelling was used to estimate the relationship between the independent variable (bonding) and the mediator (rumination), and the mediator and the dependent variable (mood) when the independent variable is controlled. The first set of meditational models were estimated to explore the third hypothesis that state RSF would mediate the concurrent relationship between state mood and state bonding and whether the reverse of this relationship was also true, with
state bonding mediating the relationship between state RSF and state mood. In the first model (model 1) the proposed causal variable was state mood, the mediator was state RSF, and the outcome variable was state bonding. Parameter estimates are presented in table 1. The Sobel (1982) procedure was used to determine whether the reduction in the effect of bonding, after including the mediator (state RSF) in the model, was significant. First, state bonding was significantly related to state RSF (path $a; c = .26, SE = .02, t(752) = 9.50, p < .001$). In this pathway, bonding is specified as a fixed effect; allowing bonding to vary at the participant level did not significantly improve model fit, change in log likelihood, $\chi^2(2) = 2.17, p > .90$. This indicates that the effect of state bonding on state RSF did not vary significantly at the participant level and that this was not a fully random effects model. Given that at least one of the indirect pathways in the model was fixed and did not vary randomly at level 2, we continued the mediational analysis using the Baron and Kenny (1986) steps (Kenny et al., 2003).

Next, the effect of state RSF on state mood was estimated, path $b, c = .42, SE = .04 t(793) = 10.09, p < .001$, followed by the unmediated effect of state bonding on state mood (path $c; c = .36, SE = .03, t(751) = 12.31, p = <.001$). Finally, the effect of state RSF and state bonding on state mood was estimated when controlling for state RSF (path $c'$). When state RSF was controlled for, the direct effect of state bonding on state mood was reduced, but remained significant, path $c', c = .27, SE = .03 t(749) = 9.23, p < .001$. The Sobel test indicated that state RSF was a partial mediator of the influence of state mood on state bonding ($z = 8.17, p <.001$).

We then estimated a reversed model in which state bonding was tested as a mediator of the effect of state RSF on state mood. State RSF was significantly related to state bonding (path $a; c = .38, SE = .05, t(753) = 7.60, p = <.001$). State bonding also had a
significant effect on state mood, path \( b \), \( c = .36, SE = .03, t(753) = 12.00, p < .001 \). Next, the unmediated effect of state RSF on state mood (path \( c \)) was estimated and equalled \( c = .42, SE = .04, t(793) = 10.50, p < .001 \). Finally, when state bonding was controlled for the direct effect of state RSF on state mood was reduced, but remained significant, path \( c' = .31, SE = .04, t(749) = 7.75, p < .001 \). The Sobel test indicated that state bonding was a partial mediator of the influence of state mood on state RSF (\( z = 6.42, p < .001 \)). Together, these models suggest that concurrently both state RSF and state bonding are plausible mediators in the relationship between state bonding, mood and state RSF, however it is difficult to conclusively unpack these relationships.

5.5.5 Is there a prospective relationship between state bonding, state ruminative self-focus and state mood?

To test hypothesis four, a prospective meditational model was estimated to explore whether state bonding on day one would predict state mood on day two, and whether state RSF on day two would mediate this relationship. In model three the proposed causal variable is state bonding at time 1 (T1), the mediator is state RSF at time 2 (T2), and the outcome variable is state mood at time 2 (T2).

First, the effect of T1 bonding on T2 state RSF (path \( a \)) was estimated whilst controlling for T1 state RSF, \( (c = .09, SE = .03, t(644) = 2.87, p = .002) \). In this pathway, bonding is specified as a fixed effect; allowing bonding to vary at the participant did not significantly improve model fit, change in log likelihood, \( \chi(2) = 0, p > .05 \). Given that one of the indirect pathways in the model is fixed, the mediational analysis was again continued using the Baron and Kenny (1986) steps.
Next, the effect of T2 state RSF on T2 mood was estimated (path $b$). Time 2 state RSF had a significant effect on T2 mood, whilst controlling for T1 state RSF and T1 mood (path $b$, $c = .48$, $SE = .04$, $t(683) = 10.71$, $p < .001$). The unmediated effect of T1 bonding on T2 mood (path $c$) was then tested whilst controlling for T1 mood ($c = 0.18$, $SE = .03$, $t(652) = 3.08$, $p = .001$). Finally, when T2 state RSF was controlled for, the direct effect of T1 bonding on T2 mood was no longer significant in the model ($c = .02$, $SE = .02$, $t(634) = 1.27$, $p = .10$). The Sobel test confirmed that T2 rumination fully mediated the effect of T1 bonding on T2 mood ($z = 2.91$, $p = .004$).

Further analyses explored a reverse effect to test whether T1 state RSF was predictive of T2 state bonding. In this model, T2 state mood was tested as a mediator of the effect of T1 RSF on T2 state bonding. In this model the effect of T1 state RSF on T2 state mood (path $a$) whilst controlling for T1 mood was not significant ($c = .01$, $SE = .04$, $t(695) = .25$, $p = .40$). Further, the unmediated effect of T1 RSF on T2 bonding (path $c$) was estimated whilst controlling for T1 bonding, and was also not significant ($c = 0.03$, $SE = .04$, $t(651) = .65$, $p = .26$). Further, mediation requires a significant relationship between the independent variable and the mediator (Baron and Kenny, 1986). Therefore it is possible to conclude that T1 state RSF does not directly predict T2 state bonding, and that T1 state RSF does not predict T2 state bonding indirectly via T2 state mood. Together these models suggest that state RSF at time 2 occurs in response to poorer state bonding at time 1. Further, state RSF at time 2 mediates the effect of T1 state bonding on T2 state maternal mood, but does not prospectively demonstrate that T1 RSF impacts on T2 state bonding.
5.6 Discussion

This study demonstrated that state maternal bonding predicts daily prospective state ruminative self-focus and state maternal mood, and that state ruminative self-focus mediates the relationship between state bonding and state mood. The reverse relationship was not found; state ruminative self-focus did not prospectively predict state bonding, or state mood, suggesting that the observed prospective relationship between state bonding and state ruminative self-focus in this sample was unidirectional.

As hypothesised, a concurrent relationship between state ruminative self-focus and state bonding was found, and in partial support of our second hypothesis, depressive symptoms were associated with mean levels of state ruminative self-focus and state bonding. Higher dispositional rumination was also associated with higher state ruminative self-focus (but not state bonding), even after controlling for depressive symptoms. These findings are consistent with existing literature demonstrating that depressive symptoms and dispositional rumination are associated with momentary ruminative self-focus (Moberley & Watkins, 2008). The present study extends these findings by further demonstrating that maternal depressive symptoms are associated with daily bonding with infant in everyday contexts and settings. Contrary to our predictions, mean levels of dispositional rumination were not associated with state bonding, and a measure of general bonding was not associated with state ruminative self-focus or state bonding.

5.6.1 State ruminative self-focus mediates the relationship between state bonding and state mood

When examining prospective relationships, the results of this study demonstrated that only state bonding at time 1 predicts state mood at time 2, and that this
relationship was fully mediated by state ruminative self-focus at time 2. An important extension of this finding is that this study has also demonstrated that state ruminative self-focus at time 1 did not prospectively predict state levels of bonding at time 2. These findings suggest that in the every-day lives of the participants in this study, perceived bonding predicted greater prospective levels of rumination, which was in turn associated with lower mood. This finding is congruent with research showing that baseline levels of perceived bonding with infant predict dispositional rumination at a six month follow-up, but baseline levels of dispositional rumination do not prospectively predict perceived bonding at six months (Tester-Jones et al., unpublished manuscript). However in contrast to previous research, the relationships in the present study were identified using more direct and naturalistic assessment methods. The findings of this study build on our understanding of the relationship between rumination, bonding and negative affect by calling attention to how these processes function in day to day parenting contexts and situations.

5.6.2 Maternal bonding and Goal Theory of rumination

Consistent with Goal Theory of rumination, the unidirectional prospective relationship observed in this study also lends credence to the notion that viewing rumination as repetitive thinking about a goal discrepancy (Martin et al., 1993) may be particularly relevant in the postnatal period. We speculate that a mother who does not feel bonded with her infant may feel there is a discrepancy between her perceived current bond, and the bond she would like to feel with her infant. In this situation, the initial inward focus associated with rumination may serve as a method of problem-solving and making progress towards the unattained goal (i.e. improved bonding) (Watkins and Baracaia, 2001). Ongoing repetitive thought, however, particularly when it is focused on negative emotional
aspects associated with a problem, may prove unhelpful (McIntosh, Gillanders and Rodgers, 2010). Further research that directly measures content of rumination is needed to firmly establish whether impairments in perceived bonding do precede rumination in mothers.

It is noteworthy that a measure of general bonding (assessing recent feelings of closeness towards the infant) was not found to be associated with state ruminative self-focus, suggesting potentially differential parenting processes and day to day maternal experiences acting on daily rumination as opposed a more general, overall feeling of closeness with the infant.

5.6.3 Limitations

One limitation of this study is the method by which assessments of daily rumination, bonding and maternal mood were made. The daily diary method relied on retrospective reports of the entire day. Such retrospective reports of affective and cognitive states experienced throughout the day can be vulnerable to recall bias (Stone et al., 1998). They may also be less effective in examining ruminative thought as an ongoing process that fluctuates over time, in response to real time emotional experiences (Moberly and Watkins, 2008). As such this study is not able to inform on the time course of a ruminative episode or its temporal relationship to fluctuations in mood and feelings of closeness with infant as they happen moment by moment. To the authors’ knowledge this is the first study to use a more ecologically valid method of assessing the prospective relationships between rumination, bonding and mood in a postnatal context, but future research may consider using Ecological Momentary Assessment (EMA) to examine these relationships further.
A second limitation of this study is the way in which ruminative self-focus was operationalised. The three item scale used in this study was adapted from a novel assessment of ruminative self-focus used by Moberly and Watkins (2008) and assessed key elements of rumination including a self-focus on emotions, and an evaluative and analytical thinking style. However, future research may consider also capturing the repetitive or self-focused nature of repetitive thought. It is also possible in this study that reporting on ruminative self-focus may have influenced subsequent reports of mood and bonding. However, given that the assessment of rumination was not explicitly focused on any aspects of negative affect, it was judged that the impact would be minimal.

Finally, this study was conducted with a community sample of mothers, and we recognise that the relationships between state bonding, rumination and mood may differ in mothers diagnosed with postnatal depression. Given the potential clinical applications of understanding the impact of impaired bonding on ruminative thinking and maternal mood, it will be important for future research to examine these relationships with a clinically depressed sample of mothers in the postnatal period.

5.6.4. Conclusions

In conclusion, this study contributes to our understanding of how ruminative thinking occurs in real-life, everyday contexts and settings and in response to real emotional experiences between mother and infant. By exploring daily ratings of ruminative thought, bonding and mood, we found that self-reported difficulties in bonding with infant play an active role in the development of dysphoric mood via ruminative thinking. Conversely, we did not demonstrate that rumination drives poorer bonding and lower maternal mood. These findings are broadly consistent with Goal Theory of rumination,
although it will be important to assess the content of rumination to confirm this. These findings also contribute to our understanding of the temporal relationships between rumination, bonding and mood at a state level and about how specific cognitive processes such as rumination are associated with the mother’s feelings of closeness with her infant. Clinically, the results of this study suggest a potential role for the early screening of perceived difficulties in the mother-infant relationship as a preventative factor in the development of maternal dysphoric mood as well as targeting the role of ruminative thinking in mothers experiencing low mood in the postnatal period.
5.7 Appendix A: State ruminative self-focus, state bonding and state mood transformation

An important assumption of HLM is that level one residuals are normally distributed. Thus, while it is not necessary for variables to be normally distributed, skewed data may be problematic if it results in cases with large residuals (e.g. > 3; Field, 2013). As such, skew and kurtosis of the level 1 study variables were examined prior to the main analyses being conducted. Aggregated scores across diary days for state maternal mood demonstrated substantial negative skewness, $z$ skewness = 1.00, $z$ kurtosis = .67, and ruminative self-focus was moderately positively skewed, $z$ skewness = .61, $z$ kurtosis = -.36. State bonding was also substantially negatively skewed, $z$ skewness = -1.43, $z$ kurtosis = -1.84. Log transformations were used to address this issue in an attempt to normalize each variable. The log transformed data was approximately symmetric (State ruminative self-focus, $z$ skewness = .18, $z$ kurtosis = -.77; state mood, $z$ skewness = -.29, $z$ kurtosis = .01; state bonding, $z$ skewness = .33, $z$ kurtosis = -1.01) although state ruminative self-focus and state bonding were slightly platykurtic (Figures 5.5 to 5.7). Furthermore, a visual examination of the normal probability plot using the transformed data in MLwiN software confirmed that the normality assumption was valid; the points on the Normal plot lie approximately on a straight line (Rabash, Steele, Browne & Goldstien, 2009; Figure 5.13).
Figure 5.6

Distribution of state maternal mood before (left) and after (right) Log transformation

Figure 5.7

Distribution of state ruminative self-focus before (left) and after (right) Log transformation
**Figure 5.8**

Distribution of state bonding before (left) and after (right) Log transformation

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**Figure 5.9**

Normal probability plot of level 1 residuals
5.8 Appendix B: Bivariate correlations between state and dispositional variables

Table 5.1 summarizes the correlations, means and standard deviations of the study variables. Consistent with previous literature, all inter-correlations between depressive symptoms, dispositional rumination and general bonding (PBQ) were significant, with those between depressive mood and brooding rumination being the most substantial ($r > .70$). Brooding rumination was also significantly related to the PBQ, and weaker correlations between the RRS reflection subscale and the PBQ can also be seen. Notably, whilst state mood and state ruminative self-focus were significantly correlated with each other, and with the dispositional variables, state bonding was not significantly related to any state or dispositional variables.
Table 5.1

Pearson correlations and summary of means and standard deviations of the measured variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>M</th>
<th>SD</th>
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<tr>
<td>1 EPDS</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>9.60</td>
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<td>2 RRS (total)</td>
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<td>--</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>46.80</td>
<td>17.90</td>
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<tr>
<td>3 RRS (brooding)</td>
<td>.72**</td>
<td>.84**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.31</td>
<td>4.01</td>
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<tr>
<td>4 RRS (Reflection)</td>
<td>.56**</td>
<td>.79**</td>
<td>.76**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.90</td>
<td>3.10</td>
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<tr>
<td>5 PBQ</td>
<td>.56**</td>
<td>.56**</td>
<td>.51**</td>
<td>.45**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>36.30</td>
<td>12.23</td>
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<tr>
<td>6 State mood</td>
<td>.54**</td>
<td>.38**</td>
<td>.50**</td>
<td>.31**</td>
<td>.31**</td>
<td>--</td>
<td></td>
<td></td>
<td>6.90</td>
<td>2.10</td>
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<tr>
<td>7 State bonding</td>
<td>.24</td>
<td>.15</td>
<td>.21</td>
<td>.03</td>
<td>.13</td>
<td>.14</td>
<td>--</td>
<td></td>
<td>8.30</td>
<td>2.10</td>
</tr>
<tr>
<td>8 State RSF</td>
<td>.42**</td>
<td>.40**</td>
<td>.44**</td>
<td>.35**</td>
<td>.29**</td>
<td>.24*</td>
<td>.40**</td>
<td>--</td>
<td>8.20</td>
<td>3.90</td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01, ***p < .001; EPDS = Edinburgh Postnatal Depression Scale; RRS = Response Styles Questionnaire (dispositional rumination); RRS (brooding) = Response Style Questionnaire brooding subscale; RRS (Reflection) = Response Styles Questionnaire reflection subscale; PBQ = Postpartum Bonding Questionnaire; State RSF = state ruminative self-focus
5.9 Appendix C: Supplementary analysis: Depressive symptoms, dispositional rumination and bonding as moderators of the concurrent relationship between state bonding and state ruminative self-focus

A supplementary analysis (HLM) was undertaken to assess whether depressive symptoms, dispositional rumination (and the brooding subscale) and bonding (PBQ) moderated the concurrent relationship between state bonding and state ruminative self-focus. Section 5.5.3 summarizes the associations between dispositional factors, state bonding and state ruminative self-focus, and the following section details the results of the moderation analyses.

Depressive symptoms (EPDS) We examined the lower order and interactive effects of depressive symptoms and state bonding on state RSF. Both Depressive symptoms \( (b = .37, SE = .17, t (65) = 2.18, p = .02) \) and state bonding \( (b = .59, SE = .68, t (65) = 3.42, p < .001) \) were significantly associated with state RSF. However, the interaction between depressive symptoms and state bonding was not a statistically significant predictor of state RSF \( (b = .59, SE = .68, t (65) = .87, p = .19) \). Because of the bidirectional nature of the relationship between state bonding and state RSF, a reverse relationship was also tested wherein the interactive effects of depressive symptoms and state RSF on state bonding were examined. When entered together, state RSF \( (b = .59, SE = .18, t (65) = 3.28, p < .001) \), but not the EPDS \( (b = .24, SE = .33, t (65) = .73, p = .23) \) was associated with state bonding, and the interaction effect was also not significant \( (b = -.02, SE = 1.62, t (65) = .01, p = .49) \). Together these results suggest that depressive symptoms do not moderate the concurrent relationship between state bonding and state RSF.
Dispositional rumination (RRS) Similarly, we examined the effects of dispositional rumination and state bonding, with their interaction term, on state RSF. Both dispositional rumination \((b = .56, \ SE = .13, \ t (65) = 4.31, \ p < .001)\) and state bonding \((b = .23, \ SE = .06, \ t (65) = 3.83, \ p < .001)\) were significantly associated with state RSF. The interaction between depressive symptoms and state bonding was also a statistically significant predictor of state RSF, \(b = -.98, \ SE = .41, \ t(68) = -2.35, \ p = .01\), indicating that the relationship between state bonding and state rumination was influenced by dispositional rumination. To explore the relationship between state bonding and state RSF at varying levels of dispositional rumination, high dispositional rumination was designated as \(1 SD\) below the mean, and low dispositional rumination was \(1 SD\) above the mean. Two new models were then estimated for high and low dispositional rumination respectively. When high dispositional rumination was entered into the model, state bonding was not significantly related to state RSF \((b = .07, \ SE = .09, \ t(68) = .63, \ p = .27)\). However, when low dispositional rumination was entered, the association between state bonding and state RSF was significant \((b = .37, \ SE = .09, \ t(68) = .78, \ p = .22)\). This pattern of findings indicates that for persons who report a more ruminative response style, there is no relationship between bonding and RSF at a state level, but when dispositional rumination is low state bonding is associated with state RSF. Figure 5.13 presents the simple slopes for the association between state bonding and state RSF at high and low levels of dispositional rumination.

Again, a reverse relationship was also tested and the interactive effects of dispositional rumination and state RSF on state bonding were examined. When entered together, state RSF \((b = .64, \ SE = .18, \ t (68) = 3.56, \ p < .001)\), but not dispositional rumination \((b = .11, \ SE = .25, \ t (68) = .44, \ p = .33)\) was associated with state bonding,
and the interaction effect was also not significant ($b = -1.55$, $SE = 1.05$, $t (65) = -1.48$, $p = .07$).

**Figure 5.10**
Simple slopes for the concurrent association between state bonding and state ruminative self-focus at high (mean - 1 SD) and low (mean + 1 SD) levels of dispositional rumination.

Note: State RSF = state ruminative self-focus; RRS = Response Styles Questionnaire (dispositional rumination); high state bonding = better perceived bonding with infant.

**Bonding** Finally, we examined the lower order and interactive effects of a measure of recent feelings of bonding with infant (PBQ) and state bonding on state RSF. When entered together both the PBQ ($b = .44$, $SE = .19$, $t (64) = 2.32$, $p = .01$), and state bonding ($b = .24$, $SE = .07$, $t (64) = 3.42$, $p < .001$) were significantly associated with state RSF, demonstrating that state bonding is associated with state RSF whilst also controlling for the PBQ. However, the interaction between the PBQ and state bonding was not a significant predictor of state RSF ($b = .02$, $SE = .65$, $t (64) = $

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2 For all moderation models estimated with dispositional rumination, when the brooding subscale was entered into the interaction term in place of the RRS total, the interaction was not significant.
The reverse relationship was again tested and revealed that state RSF ($b = .62$, $SE = .18$, $t (64) = 3.44$, $p < .001$), but not the PBQ ($b = .03$, $SE = .34$, $t (64) = .09$, $p = .46$) was associated with state bonding, and the interaction effect was also not significant ($b = -.31$, $SE = 1.45$, $t (64) = -.21$, $p = .42$). Again these results indicate that the PBQ is not a moderator of the relationship between state bonding and state RSF.
CHAPTER 6: An experimental study to investigate how inducing rumination in dysphoric mothers will affect mother-infant interaction

6.1 Preface
In chapters 3 to 5 of this thesis, the concurrent and prospective relationships between rumination, maternal attunement and depressive symptoms were empirically tested. Consistent with previous literature (e.g. Barnum, Woody & Gibb 2012; Müller et al., 2012) and theoretical models which indicate that rumination occurs as a response to failure to reach a goal (i.e. goal discrepancy; Tesser, Martin & McIntosh, 1993), the results from chapters 3, 4 and 5 indicated a concurrent relationship between depressive symptoms, rumination and self-reported maternal attunement (Chapter 3), and a prospective relationship wherein deficits in perceived bonding predicted greater levels of rumination and lower mood both over a six month period (Chapter 4) and at a state, daily level (Chapter 5). In contrast, rumination did not predict lower levels of perceived bonding in both prospective studies.

However, the immediate causal relationship between rumination and objective maternal behaviours has yet to be established. There is evidence from a recent study that brooding rumination predicted the persistence of depressive symptoms across pregnancy to two months postpartum, and was further related to the maintenance of depressive symptoms in the postpartum period (Barnum, Woody & Gibb 2012). In two different correlational studies, ruminative thinking was also associated with self-reported impairments in the mother-infant relationship (Müller et al., 2012) and in poorer parental problem solving (O’Mahen, Boyd and Gashe, 2015). Recent research has also demonstrated a trend that highlights the potential for a causal relationship between rumination and maternal behaviours (see a discussion of the findings of Stein et al., 2012 in section 2.4.5). The aim of this study (study 4) was to evaluate whether
experimentally manipulated rumination in dysphoric mothers was causally implicated in less sensitive maternal behaviours (thesis hypothesis 3) in a play interaction task with their infant, compared to non-dysphoric mothers. In this study, rumination was induced via a goal-cueing manipulation adapted to be parenting specific (see section 6.4.2 for further details). To date, Morrow and Nolen-Hoeksema’s (1990) response manipulation task has been widely used to induce a ruminative thinking style in experimental studies. However, using this task has some potential drawbacks. First, the task has a short period of impact, with evidence to demonstrate that the effects of such manipulations wear off quickly (e.g. Clark, 1983). Second, the effect of the manipulation may be easily offset by other environmental factors that provide a distraction, such as a crying infant (Morrow & Nolen-Hoeksema, 1990). Both of these factors are very important to consider with postnatal mothers and when examining behavioural outcomes. For example, postnatal mothers are frequently sleep deprived and may therefore have lower sustained attention in experimental tasks. It is therefore critical to have a manipulation task that is powerful. In addition, when looking at behavioural outcomes such as mother-infant interactions, it is important to have manipulations that will have a lasting and strong impact. Increasing the self-relevance of the task may lead to a more powerful manipulation (e.g. Riemann & McNally, 1995; Brown & Taylor, 1986).

The manipulation task used in study 4 was based on the Goal theory definition of rumination as opposed to conceptualisations that focus on the maladaptive consequences of rumination as a response primarily to negative mood (e.g. Response Styles Theory, Nolen-Hoeksema, 1991). It is important to note that Goal Theory predicts effects of this manipulation for anyone, not just an individual who is focussing on their sad mood. Further, using this definition of rumination is consistent with the findings of this thesis in Chapters 3 and 4, which highlight that greater reported deficits in perceived bonding (i.e. discrepancies between a mothers actual and ideal relationship
with her infant) predict greater levels of rumination. This task has been used successfully in previous studies (e.g. Roberts et al., 2013)

Dysphoric (scoring above 14 on the BDI-II) and non-dysphoric (scoring below 10 on the BDI-II) mothers were recruited for the study. Because previous studies of rumination have found similar patterns of results for clinical and sub-clinical populations interacting with a rumination condition, and due to challenges and time frame available for recruitment, a dysphoric population of mothers was deemed appropriate for the purposes of this study. Study 4 had full NHS ethics approval and participants were recruited from GP services across the Devon area, Torbay CAMHS and the Women’s center at the Royal Devon and Exeter hospital as well as via health visitors at children and family centers across Exeter. Recruitment and subsequent testing of the full sample of mothers spanned three years, with recruitment of the dysphoric sample being particularly slow. Dysphoric mothers were very rarely present at community mother and baby groups. Consequently, successful recruitment of this sample relied on first building a successful network of contacts within local NHS support services that were willing and able to support the study and approach eligible mothers about the study. Building and maintaining this network was a particular challenge, and required regular attendance at a number of health visiting centers, children’s centers, GP surgeries and the Women’s Centre in order to build relationships with staff, obtain their support, and encourage them to approach potentially eligible participants on an ongoing basis.

Testing each mother-infant dyad in the study took approximately one and a half hours. On some occasions, if the infant was asleep on arrival or was particularly distressed, an alternative appointment had to be made instead. Many participants also opted to take part in the study in their own home, which sometimes required travel
within up to a two hour radius of the University. Due to the overall length of time taken to conduct this study, training that was undertaken to code the mother-infant interactions had to be repeated in order to maintain reliability and to prevent coders drift. Three separate interaction periods were coded for each participant, with each interaction taking approximately half an hour to code. Thus, each of the 79 participants produced approximately an hour and a half of coding work.

An a priori power analysis was conducted prior to data collection (using G* power application) to estimate the number of participants required to minimize the risk of type II error (Appendix A). Appendix C also details the method and results of an additional task that was run with this sample as a preliminary exploration of the causal role of experimentally induced rumination on attentional disengagement from infant stimuli. This task was carried out following the procedures detailed in the main body of this chapter, but prior to debriefing. It is of note that the study was not powered to detect the effects of rumination in this additional task. The paper presented in the main body of this chapter is currently being prepared for submission to the Journal of Abnormal Psychology.
Postnatal maternal depressive symptoms are consistently associated with reduced quality of mother-infant interaction, including increased withdrawal and unresponsiveness and reduced sensitivity. However, there is little research examining the causal role of maternal cognitive factors (e.g. rumination) in the relationship between depressive symptoms and mother-infant interaction quality. This study investigated the hypotheses that (1) dysphoric mothers will demonstrate less sensitive behaviour towards their infants compared to non-dysphoric mothers (2) that mothers induced to ruminate will be less sensitive in their behaviour towards their infants compared to those in a control condition and (3) rumination will moderate the relationship between maternal depressive symptoms and maternal sensitivity. Mothers (N = 79; 39 dysphoric and 40 non-dysphoric) and their infants were randomised to either a rumination induction or a control condition. Mother-infant interaction quality was assessed before and after the induction via coding maternal sensitive, unresponsive and controlling behaviours, and overall mother-infant dyadic synchrony. In the second interaction task, mothers also completed the still-face situation as a stressor. Data were analysed with mixed measures ANOVA’s. Overall, dysphoric mothers demonstrated reduced quality of interaction with their infant compared to non-dysphoric mothers. Mothers in the rumination condition exhibited poorer dyadic synchrony and significantly reduced sensitivity towards their infants. For sensitivity, this was moderated by time such that mothers’ sensitivity further worsened after the still face procedure in the rumination condition, but not in the control condition. Rumination did not moderate the effect of depressive symptoms on these measures of mother-infant interaction. Whilst a main effect of dysphoric mood was found on maternal unresponsive and controlling behaviours, there was no effect of rumination on these
measures. This study builds on our understanding about how specific cognitive processes such as rumination are causally implicated the mother’s ability to sensitively respond to her infant.
6.3 Introduction

There is considerable evidence demonstrating that postnatal depression (PND) is associated with negative child outcomes (Grace, Evindar & Stewart, 2003) and this relationship appears to be at least partly mediated by disturbances in the mother-infant relationship. Although there is a strong research base demonstrating that there are specific behavioural mechanisms associated with PND and the disruption in the mother-infant relationship (e.g. Stein et al., 2010), there is as yet little research investigating maternal cognitive processes that may help improve our understanding about factors influencing maternal behaviours towards the infant, particularly in the context of depressed mood. In this study, we examined the impact of rumination, defined as a “class of conscious thoughts that revolve around a common theme and occur in the absence of immediate environmental demands requiring the thoughts” (Martin & Tesser, 1996, p. 7) on mother-infant dyadic interactions. In the general depression literature there is strong evidence linking rumination to the onset and maintenance of depression (Lyubomirsky, Caldwell & Nolen-Hoeksema, 1998; Lyubomirsky, Kasri, & Zehm, 2003). We therefore proposed that rumination, by virtue of its internal, self-focused nature (Nolen-Hoeksema & Morrow, 1991), and its role as a passive, avoidant, emotion regulation strategy (Moulds et al., 2007), would reduce sensitive maternal responding to the infant, and increase maternal unresponsiveness.

6.3.1 Postnatal depression and maternal sensitivity

A substantial body of research has demonstrated that low maternal mood is associated with disturbances in mother-infant interaction (Beck, 1995; Field, 2010; Poobalan et al., 2007). For example, Murray, Kempton, Woolgar & Hooper (1993) found that at three months postpartum, mothers with PND expressed more negative
affect, were less focused on infant experience and tended to show less acknowledgement of infant agency than a control group. Longitudinal studies using observational methods have also found that mothers with PND exhibit less engagement with their infant, less sensitive attunement with the infant (e.g. mother’s ability to empathise with her infant), greater negative responsiveness and less positive responsiveness to the infant (Cooper et al. 1999; Stanley et al., 2004). Mothers who have PND are more likely to behave in ways that are associated with being less attuned to their infant and more likely to engage in avoidant/disengaged behaviours towards the infant. However, it is unclear what mechanisms might explain why these behaviours happen, particularly amongst depressed mothers. We propose that cognitive mechanisms, such as rumination, may have an important impact on maternal behaviours towards her infant.

6.3.2 Rumination and maternal sensitivity

In the broader depression literature, studies have demonstrated that rumination focuses an individual’s attention inwards, rather than outwards towards the environment, and serves to magnify negative stimuli (Lyubomirsky & Nolen-Hoeksema, 1995; Watkins, 2008). As such, rumination may be an important factor involved in maternal sensitivity, potentially focusing attention away from infant behavioural and emotional cues, and biasing attention towards negative stimuli (Stein et al., 2010; Donaldson, Lam and Matthews, 2007). Stein and colleagues (2012) proposed that rumination, a type of preoccupation, may interfere with aspects of mental functioning that are critical for parenting well, especially attention and responsivity to the environment. These decrements may therefore reduce the mother’s ability to effectively respond to her infant’s cues and needs. Other recent literature focusses on
the conceptualization of rumination as an avoidant emotion regulation strategy (Watkins and Moulds, 2004; Moulds, et al., 2007). Considering rumination in this way may also aid explanations of the withdrawn and disengaged behaviours observed in depressed mothers when interacting with their infants.

Recent studies have provided preliminary evidence that ruminative thinking in the context of depression impacts on mother-infant variables (e.g. Barnum et al., 2012; O’ Mahen et al., 2010). Stein and colleagues (2012) found that a rumination induction negatively impacted the responsiveness of mothers with GAD to their infants, relative to those who received a distraction induction. A similar, non-significant, trend was observed in mothers with depression. These results suggest that cognitive mechanisms such as rumination and worry may play a role in mother-infant interaction. However, consistent with previous studies in the rumination area, the type and length of induction may be an important factor when investigating behavioural outcomes. Stein and colleagues used a rumination induction that was adapted from a worry prime, and it is possible that a longer observational period may allow for a wider range of behaviours, responses and emotions to be identified both in the mother and the infant. Further, the rumination induction may not have been powerful enough to elicit behavioural effects. In most experimental studies of rumination, rumination has been induced using a response manipulation task (Morrow & Nolen-Hoeksema, 1990) requiring participants to think about and focus on items that were emotion focussed, symptom focussed and self-focussed. However, given that a number of studies have demonstrated that increasing the self-relevance of inductions increases the impact of the induction (e.g. Brown & Taylor, 1986; Riemann & McNally, 1995), a rumination induction that includes self-relevant material may not only be more powerful, but would also be ecologically valid.
The present study has used a more self-relevant rumination induction adapted from Roberts et al. (2013). The rumination condition, which has successfully elicited rumination in a previous study (Roberts et al., 2013), asked participants to identify an ongoing and unresolved concern that had repeatedly come into their mind and caused them to feel negative or stressed during the previous week. This induction is consistent with Goal Theory approaches to rumination, which conceptualize rumination as resulting from a discrepancy between individual goals and environmental feedback about progress towards the goal. Goal theory posits that when the discrepancy is unresolvable or if the focus of problem-solving is at an abstract level, then rumination, regardless of mood state, serves a negative function. It is noteworthy however that note that Goal Theory does not hold that the individual need be depressed and focused on their depressed mood state, only focused on a discrepancy. Thus, Goal Theory would predict that any individual ruminating about a goal discrepancy would demonstrate self-focused effects.

6.3.3 The present study

The present study proposes that dysphoric mothers will demonstrate less sensitive behaviour towards their infants compared to non-dysphoric mothers. Consistent with a Goal Theory approach, it is also hypothesised that mothers induced to ruminate about self-referential material will be less sensitive in their behaviour towards their infants compared to those in a control condition. Finally, we also expected rumination to moderate the relationship between maternal depressive symptoms and maternal sensitivity.

Tronick & Reck (2009) propose that depressed mothers who are exhibiting disrupted mother-infant interaction may display 1) controlling, intrusive and angry behaviours or 2) disengaged, unresponsive and withdrawn behaviours (Malphurs, Raag,
Field, Pickens & Pelaez-Nogueras, 1996). We hypothesise that poorer mother-infant interactions may be expressed either via a reduction in sensitivity to the infant or poorer mother-infant dyadic synchrony, or an increase in unresponsive behaviours or controlling behaviours.

Finally, it has been shown that difficulties in parent-child interaction emerge in more stressful or challenging contexts compared to unstructured situations (Ginsburg, Grover, Cord, & Ialongo, 2006). We therefore examined the impact of rumination both during free play and following a stressor task designed to disrupt the flow of the interaction, requiring the mother and infant to make successful reparations. We hypothesized that:

1. Dysphoric mothers would demonstrate less sensitivity towards their infants and poorer quality mother-infant interaction overall compared to non-dysphoric mothers.

2. Rumination would moderate the relationship between maternal depressive symptoms and maternal sensitivity such that dysphoric mothers in the rumination condition would demonstrate the poorest quality interactions with their infants. We expect that an experimentally induced rumination task will significantly interfere with a mother’s ability to successfully attend to her infant, resulting in more negative interaction behaviours.

3. We expected that the impact of the rumination induction would be increased following the still face task such that the most negative interaction behaviours will be observed in the dysphoric/rumination group, after the Still-face presentation.

4. Dysphoric mothers in a distraction condition would demonstrate more appropriately responsive interaction behaviours.
The non-dysphoric mothers would demonstrate sensitive and appropriately interactive behaviours in both conditions, compared to the dysphoric mothers.

6.4 Method

6.4.1 Participants

Seventy-nine mother-infant dyads were recruited through community health visitors and GP surgeries, mother and baby groups and children’s centers based in the South West of England. The mean age of mother was 32.2 (SD = 4.4), and the mean age of infant was 7.2 months, (SD = 2.9). Women were invited to participate if they had given birth within the last 12 months, were 18 years or older, could speak English, had no current experience of psychosis and met the criteria for either non-dysphoric with a score of below 10 on the Beck Depression Inventory (BDI II) or dysphoric, scoring above 14. To ensure equity between the dysphoria and non-dysphoria conditions we oversampled dysphoric women, resulting in 39 women with a BDI score above 14 and 40 with a BDI score lower than 10. The study was approved by The South West Research National Health Service Research Ethics Committee, Devon Primary Care Trust and Torbay Primary Care Trust. All participants gave informed signed consent.

6.4.2 Measures and materials

Dysphoric symptoms were assessed using the Beck Depression Inventory-II (BDI II). The BDI–II assesses levels of depressive symptomatology with 21 items that are rated on a scale from 0 to 3, with higher scores reflecting more depressive symptoms. Reported sensitivity (ranging from 43% to 82%), specificity (89%) and positive predictive value (50%) of the BDI-II in perinatal populations is good (e.g. Gaynes et al., 2005; Lee et al., 2001). Cronbach’s alpha in our sample was .94.
Trait rumination was assessed with the Response Styles Questionnaire (RRS Revised). This version combines the original 22 item version (Nolen Hoeksema & Morrow, 1993) with the recent version reported by Treynor et al. (2003). Items common and unique to both versions were included (25 in total on a 4-point likert) such that the full range of ruminative responses (for example, reflection versus brooding; Treynor et al., 2003) could be calculated. The RRS scale demonstrated excellent internal consistency in this study (α = .96).

Current Mood. Participants were asked to indicate their current mood (please identify your current mood) on a single likert type scale of 1 to 10 (where 1 = lowest mood, and 10 = highest mood).

Current feelings of depression. A Visual Analogue Scale (VAS) for feelings of depression was used to assess current depressed mood both before and after the rumination inductions. The participant was asked to indicate how depressed they are feeling along a continuum of 0-100 where 0 = no depressed mood, and 100 = severe depressed mood).

Mother-Infant interaction quality. Mother-infant interaction behaviour during free play was scored from videotapes using the Child-Adult Relationship Experimental Index (CARE Index; Crittenden, 2003) by two coders (blind to study conditions, variables and hypotheses) who were trained to reliability. A third coder, trained and certified as reliable, scored 31 (15%) of the video interactions selected randomly in order to assess intercoder reliability. All coders underwent intensive training in the use of the CARE Index. Inter rater agreement was strong, $k = .80$. Inter rater agreement for individual scales were .80 for dyadic synchrony, .88 for maternal sensitivity, .71 for maternal control and .73 for maternal unresponsivity.
Seven aspects of behaviour (facial expression, verbal expression, position, affection, turn-taking, control and choice of activity) were evaluated on three adults scales (sensitive, controlling and unresponsive) and four infant scales (cooperative, compulsive, passive and difficult) using the CARE Index manual (Crittenden, 2004). Mother and infant are scored independently, but the coder is trained to score each aspect of behaviour from the perspective of the partner (e.g. if the mother is smiling whilst the infant is distressed, this would be considered insensitive). For each of the seven aspects of behaviour two points were allocated, either both on one scale or split between two scales. The two points can be allocated in a number of different combinations (e.g. 0 sensitive, 2 controlling or 1 sensitive, 1 controlling and 0 unresponsive) with a total of 14 points, separately for the parent and the infant, with the possible range for each scale 0–14. Higher sensitivity scores denote a more sensitive interaction, whereas higher controlling and unresponsive scores denote a less sensitive interaction. A global score of dyadic sensitivity was also derived, with the mother–infant dyads being classified as highly sensitive (scores 11–14); adequately sensitive (scores 7–10); requiring intervention (scores 5–6) and at risk (scores 0–4). Previous studies have found strong correlations between maternal sensitivity and infant cooperation; maternal controlling and infant difficulty; maternal controlling and infant compulsivity; and maternal unresponsiveness and infant passivity (Crittenden and DiLalla, 1988). Due to (1) the strong correlations between these scales, (2) the emphasis of this procedure on the dyad and coding from the other partner’s perspective and (3) the aims and hypotheses of the present study in relation to differences predicted in changes to maternal behaviour, in the analyses we used only the maternal scales to assess the quality of mother-infant interactive behaviour. The CARE index has been validated for use with families from different social classes and cultural backgrounds (Leventhal, Jacobsen, Miller, & Quintana, 2004).
Rumination induction. A Goal cueing task adapted from Roberts et al. (2013) and Behar, Zuellig and Borkovec’s (2005) worry induction was used in order to elicit rumination, or to provide a control condition by asking participants to identify unresolved or resolved problems. Examples of appropriate problems were provided, some of which were parent specific (e.g., an aspect of parenting you’re concerned you’re not managing well and it is worrying you) and participants were asked to briefly outline the problem that they had identified. In order to assess the eligibility of the problem, participants then rated the extent to which their unresolved goal had been bothering them at its worst, and in the past week as well as the proportion of time that they had spent thinking about it during that week. A 10 minute focus period followed, during which participants were asked to sit silently and work through a pre-recorded script delivered over headphones, which prompted them to focus on the concern identified. Items in the script included “think about what is important about this difficulty in terms of your personal goals” and “focus on how this problem reflects a lack of progress on important personal goals”. The control condition asked participants to spend the same period of time thinking about a concern that had previously troubled them, but that had since been resolved. Again examples were provided, including some parenting specific problems (e.g. an aspect of parenting that you previously felt you did not manage well, but that you now manage as well as other people). Items from the control script included “think about what was important about this difficulty in terms of your personal goals” and “focus on how resolving this problem reflects progress on important personal goals”.

Manipulation check; Analytical thinking. A visual analogue scale was used to assess levels of analytical thinking during the rumination or distraction induction. Participants were asked to indicate what proportion of their thoughts were concerned with try to
explain, understand or make sense of things during the induction task from 0% (none of their thoughts) to 100% (all of their thoughts).

6.4.3 Procedure

Women were approached by the experimenter in community children and family centers, and were also recruited via Health Visitors, GP surgeries and family support workers. Interested women were asked to return a slip with their contact details on (either via freepost or their healthcare provider), consenting to be contacted by phone with further information about the study. Women who agreed to receive further information about the study were initially contacted via telephone. At this time the experimenter provided further information about the study and asked the participant if she would be happy to participate in the study. Those who agreed were asked to provide initial verbal consent in order to complete a telephone screen. She was then asked to complete the BDI-II over the phone. Eligible participants were invited to complete the experiment in either the lab or at home. Upon arrival the study and procedures were described to participants and informed written consent was obtained. Participants were then asked to complete the baseline questionnaires (current mood, VAS and RRS revised). Once completed, participants were asked to engage in the mother-infant observational task using the CARE Index procedure with their infant for 5 minutes in order to gather baseline data about the interaction. The CARE Index procedure involved videotaping a brief free play mother-infant interaction of between two and five minutes. The mother was not given any specific instructions about the interaction. Instead she was asked to play with her infant as she normally would. A few age appropriate toys, a baby blanket, a baby bouncer and high chair were supplied which the mother could choose to use or not as she preferred.
Participants were then asked to complete the rumination induction. In order to prevent distractions during the goal cuing task, with the mother’s consent the infant was taken to an adjacent room with an adjoining door and cared for by the researcher. Following completion of the rumination induction, the mother was asked to complete a brief manipulation check and measure of current mood. The infant was returned and a second five minute assessment of mother-infant interaction quality was carried out. Two and a half minutes into the second assessment of mother-infant interaction, participants were asked to perform the ‘still face’ paradigm for a period of 30 seconds with the instructions to face their infant, freeze their face in a blank expression and stop talking to or playing with the infant for 30 seconds. The researcher informed participants when to begin the still face situation, and when to resume play. This task has been utilized by a number of studies to investigate the effect of alterations in maternal emotional expressions on infant behaviour (e.g. Carter, Mayes & Pajer, 1990; Moore, Cohn & Campbell, 2001).

Finally, participants were asked to complete a measure of current mood and the VAS again. All participants were then asked to take part in a distraction task in order to neutralize their mood (Morrow & Nolen-Hoeksema, 1990). Participants were asked to focus on non-self-relevant images for eight minutes (e.g. 'think about a fan slowly rotating back and forth', 'think about the layout of your shopping centre'). Participants were then fully debriefed as to the nature of the study and given the opportunity to ask questions. Before leaving, all participants spent five minutes positively interacting with their infant, and were provided with a debrief leaflet that included local and national support phone numbers and information about infant development and positive mother-infant interaction.
6.4.4 Statistical Analysis

The data were analyzed in IBM SPSS statistics 19 with mixed measures ANOVA, t tests and simple tests of main effects for each of the three maternal scales, and the ratings of dyadic synchrony (DSS). Data were checked for accuracy, missing data, outliers and normality. Scores for the DSS, maternal sensitivity and unresponsiveness demonstrated a normal distribution at baseline (T1), post induction (T2) and post still face situation (T3) and no outliers were found. The RRS was also normally distributed with no outliers. Maternal controlling scores demonstrated substantial positive skewness at T1, T2 and T3. Log transformations were used to normalize this variable at each time point. One participant was not happy to complete the still face situation due to infant distress resulting in missing scores for this participant at T3.

6.5 Results

6.5.1 Manipulation check

Analytical thinking. A two-way between subjects ANOVA was conducted to compare the effect of induction type (rumination or control) and group (dysphoric or non-dysphoric) on participants’ analytical thinking. There was no effect of mood, $F (1, 78) = 1.86, p = .18$, but as predicted there was a significant effect of induction type, $F (1, 78) = 4.08, p = .04$. Analytical thinking was significantly higher in the rumination induction condition ($M = 58.05, SD = 26.49$) than in the control condition ($M = 46.83, SD = 24.20$). Contrary to predictions however, there was not a significant two way interaction between mood and induction type, $F (1, 78) = .75, p = .39$. 

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6.5.2 Observational Mother-infant interactions

Effects of ruminative thinking on dyadic synchrony (DSS). A 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA was used to analyse global dyadic synchrony scale scores. There was a significant main effect of group, $F(1, 74) = 15.18$, $p < .001$, which reflected a lower DSS score overall in dysphoric ($M = 6.98$, $SD = 1.48$) compared to non-dysphoric ($M = 8.32$, $SD = 1.54$) mother-infant dyads. No main effect of induction type was found, $F(1, 74) = 3.42$, $p = .06$. However, a main effect of time, $F(2,148) = 7.07$, $p = .001$, demonstrated a significant decrease in dyadic synchrony across time. This was qualified with t-tests, demonstrating significant differences between T1 and T2 ($t(76) = -2.54$, $p = .01$), and T1 and T3 ($t(75) = -3.32$, $p = .001$).

There was not a significant two way time by group interaction, $F(2,148) = .37$, $p = .69$. However, as predicted, there was a significant two way time x induction type interaction on DSS scores, $F(1, 78) = 4.97$, $p = .008$. Two separate one-way repeated measures ANOVA confirmed a significant effect of time in the rumination, $F(2,74) = 13.54$, $p < .001$, but not distraction condition, $F(2,74) = .12$, $p = .88$. To unpack this relationship, we conducted t-tests to explore the effect of time in the rumination condition. There was a significant decrease in dyadic synchrony between T1 and T2, $t(37) = -3.52$, $p = .001$ ($M = -1.32$, $SD = 2.30$), but no significant change between T2 and T3, $t(37) = -1.39$, $p = .17$ ($M = -.34$, $SD = 1.51$; Figure 6.1). Contrary to predictions, there was not a significant three way time by group by induction type interaction, $F(2,148) = .39$, $p = .68$.

We conducted tests of simple main effects for group comparisons (Howell, 2002) to compare differences in DSS scores at each time point in between the rumination and distraction conditions. No significant differences were observed in DSS
scores at T1, $F(1, 78) = 5.19, p = .26$, T2, $F(1, 78) = 35.35, p = .11$ or T3, $F(1, 78) = 60.23, p = .08$ (Table 6.1).
Table 6.1:

Means (SD’s) of DSS and maternal sensitivity by induction type for each time point.

<table>
<thead>
<tr>
<th>Condition</th>
<th>DSS</th>
<th>Maternal sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
</tr>
<tr>
<td>Rumination</td>
<td>8.36 (2.57)</td>
<td>7.05 (1.85)</td>
</tr>
<tr>
<td>Control</td>
<td>8.05 (1.95)</td>
<td>7.92 (2.22)</td>
</tr>
</tbody>
</table>

Notes: DSS = Dyadic Synchrony Scale; T = time
Figure 6.1:
Estimated marginal means for Dyadic Synchrony in the rumination and distraction conditions across time points

Effects of ruminative thinking on maternal sensitivity. A second 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA was used to analyse ratings of maternal sensitivity. A significant main effect of group, $F(1, 74) = 19.60, p < .001$, again reflected lower overall sensitivity in dysphoric ($M = 6.29, SD = 2.75$) compared to non-dysphoric ($M = 8.77, SD = 2.08$) mother infant dyads. No main effect of induction type was found, $F(1, 74) = 2.33, p = .13$, but again a main effect of time was observed, $F(2,148) = 12.63, p < .001$, indicating that maternal sensitivity changed across time. Further analysis revealed significant reductions in sensitivity between (1) T1 and T2, $t(76) = -1.98, p = .05$ (2) T1 and T3, $t(75) = -4.24, p < .001$ and (3) T2 and T3, $t(76) = -3.47, p = .001$.

There was no significant two way time by group interaction, $F(2,148) = .58, p = .56$. However, the main effect of time was qualified by a significant two way time x
induction type interaction on maternal sensitivity, \( F(1, 74) = 4.08, p = .01 \). To explicate this interaction, we conducted two one-way repeated measures ANOVA of time x induction type. There was a significant effect of time in the rumination, \( F(2,74) = 17.48, p < .001 \), but not distraction condition, \( F(2,78) = 1.19, p = .31 \). We conducted t-tests to further unpack where significant change occurred within the rumination condition (Figure 6.2). A significant decrease was observed in maternal sensitivity between T1 and T2, \( t(37) = -2.84, p = .007 \) \((M = -1.36, SD = 2.96)\) and T2 and T3, \( t(37) = -3.75, p = .001 \) \((M = -1.65, SD = 2.72)\). No three way time by group by induction type interaction was found, \( F(2,148) = .44, p = .64 \).

Again tests of simple main effects for group comparisons were conducted to compare differences in sensitivity scores at each time point in both the rumination and distraction conditions. Significant differences were found at T2, \( F(1, 78) = 25.91, p = .04 \), and T3, \( F(1, 78) = 155.07, p = .006 \), but not at T1, \( F(1, 78) = 10.67, p = .08 \) (Table 6.1).

*Figure 6.2:*

Estimated marginal means for maternal sensitivity in the rumination and distraction conditions across time points
Effects of ruminative thinking on maternal unresponsiveness. Maternal unresponsiveness was analysed with a 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA. There was a significant main effect of group, $F(1, 74) = 33.54, p < .001$; dysphoric mothers had higher unresponsiveness scores ($M = 5.12, SD = 3.28$) compared to non-dysphoric ($M = 1.80, SD = 1.74$) mothers. No main effect of induction type, $F(1, 74) = .08, p = .79$, or time was found, $F(2, 148) = .67, p = .51$, demonstrating that overall, mean unresponsiveness scores were not significantly different between induction types and did not significantly change over time.

A significant two-way time x group interaction was found, $F(2, 148) = 3.71, p = .02$. A one-way repeated measures ANOVA demonstrated no significant overall effect of time in the dysphoric, $F(1, 74) = 2.39, p = .09$ or non-dysphoric group, $F(1, 78) = 1.72, p = .19$, although t-tests revealed a significant increase in unresponsiveness between T2 and T3 in the dysphoric group, $t(35) = 2.12, p = .04$ ($M = 1.16, SD = 3.36$), but not in the non-dysphoric group, $t(37) = -1.16, p = .25$ ($M = -0.40, SD = 2.17$; Figure 6.3). Contrary to predictions, a time by induction type interaction was not found, $F(1, 74) = .596, p = .55$, and there was no three way time by group by induction type interaction, $F(2, 148) = .60, p = .55$.

Tests of simple main effects for group comparisons were conducted to compare differences in unresponsive scores at each time point in both the dysphoric and non-dysphoric group. Significant differences were found at T1, $F(1, 78) = 352.54, p < .001$, T2, $F(1, 78) = 356.91, p < .001$, and T3, $F(1, 78) = 897.85, p < .001$ (Table 6.2).
Table 6.2:

Means (SD’s) of maternal unresponsive and maternal control scores by group for each time point.

<table>
<thead>
<tr>
<th>Group</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysphoric</td>
<td>4.94 (3.59)</td>
<td>4.64 (4.06)</td>
<td>5.92 (3.76)</td>
<td>.35 (.34)</td>
<td>.35 (.46)</td>
<td>.38 (.36)</td>
</tr>
<tr>
<td>Non-dysphoric</td>
<td>2.15 (2.49)</td>
<td>1.82 (1.87)</td>
<td>1.42 (2.34)</td>
<td>.40 (.27)</td>
<td>.53 (.29)</td>
<td>.66 (.32)</td>
</tr>
</tbody>
</table>
Effects of ruminative thinking on maternal control. A 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA was used to analyse maternal controlling scores. A significant main effect of group was found, $F(2, 148) = 6.62, p = .01$, but contrary to expectations higher controlling scores were found in the non-dysphoric (M = .54, SD = .21) compared to the dysphoric group (M = .40, SD = .30).

Figure 6.3:
Estimated marginal means for maternal unresponsiveness in the dysphoric and non-dysphoric conditions across time points.

No main effect of induction type was found, $F(1, 74) = 1.04, p = .31$, but again a main effect of time was observed, $F(2, 148) = 7.91, p = .001$, demonstrating that maternal control changed across time. Further analysis revealed significant increases in control between T1 and T2, $t(78) = 3.27, p = .002$ (M = .12, SD = .32) but not between T2 and T3, $t(77) = 1.06, p = .29$ (M = .04, SD = .35).

There was a significant two-way time x group interaction, $F(2, 148) = 4.37, p = .01$. Contrary to predictions, a one-way repeated measures ANOVA demonstrated a significant overall effect of time in the non-dysphoric group, $F(2, 78) = 10.89, p < .001$,
but not in the dysphoric group, $F(2, 78) = 1.45, p = .23$. Further analysis revealed significant increases in control between T1 and T2, $t(39) = 2.46, p = .01$ ($M = .13, SD = .33$), and again between T2 and T3 in the non-dysphoric group, $t(39) = 2.12, p = .04$ ($M = .13, SD = .31$). In the dysphoric group, a significant increase was observed between T1 and T2, $t(37) = 2.15, p = .03$ ($M = .10, SD = .29$) but not between T2 and T3, $t(39) = - .93, p = .36$ ($M = -.05, SD = .36$; Figure 6.4). A time by induction type interaction was not found, $F(2, 148) = 1.18, p = .30$, and no three way time by group by induction type interaction was found, $F(2, 148) = .48, p = .62$. Tests of simple main effects for group comparisons were conducted to compare differences in controlling scores at each time point in both the dysphoric and non-dysphoric group. Marginally significant differences were found at T3, $F(1, 78) = 3.65, p = .057$, but not at T1, $F(1, 78) = .121, p = .72$, or T2, $F(1, 78) = .29, p = .58$ (Table 6.2).

Figure 6.4:
Estimated marginal means for maternal for maternal controlling behaviour for dysphoric and non-dysphoric mothers across time points

![Graph showing maternal control over time for dysphoric and non-dysphoric groups.](image-url)
6.6 Discussion

This study demonstrated that a rumination induction resulted in significant changes in mother-infant interactions compared to a control condition. Consistent with previous findings, dysphoric mothers exhibited poorer synchrony and sensitivity and increased unresponsiveness when interacting with their infant relative to non-dysphoric mothers. However, we also have novel evidence that both dysphoric and non-dysphoric mothers in the rumination condition exhibited reduced dyadic synchrony and maternal sensitivity across time, compared to those in the control condition. Mothers induced to ruminate about a self-relevant goal exhibited a significant decrease in dyadic synchrony from baseline to post-rumination induction relative to mothers in the control condition. A similar pattern emerged regarding sensitivity, although maternal sensitivity also continued to worsen following the still-face procedure in mothers who were induced to ruminate relative to those in the control condition. These findings demonstrate that for the measure of maternal sensitivity, the effects of rumination were increased when the mother and infant were presented with a stressful situation (i.e. after the mother performed the still-face situation). These results support and extend previous evidence by confirming that difficulties in mother-infant interaction emerge in more stressful contexts (Ginsburg et al., 2006), and demonstrating that this appears to be exacerbated by ruminative thinking. There was no effect of rumination on maternal unresponsiveness or maternal control.

6.6.1 The effect of rumination on mother-infant interaction

We found that dysphoric mothers demonstrated poorer synchrony, sensitivity and unresponsiveness to their infant relative to non-dysphoric mothers. These results extend existing findings on maternal depressive symptoms and maternal sensitivity.
Consistent with previous literature that has found differences between dysphoric and non-dysphoric groups on observational assessments of maternal sensitivity and responsiveness (Beck, 1995; Murray, Cooper & Hipwell, 2003),

However, we also found that self-focused rumination has an important impact on mother-infant interaction. Mothers who were induced to ruminate became less sensitive, more controlling and demonstrated poorer dyadic synchrony with their infant following the induction than those in the control condition. However, contrary to our hypothesis, this effect was not stronger for mothers who were also experiencing dysphoric mood. Rather, the rumination induction resulted in reduced quality of interaction for all mothers, regardless of mood.

A possible explanation for these findings may be found in the nature of the induction task. Based on control theories of rumination, the induction task used in this study asked participants to focus on a lack of progress that they were currently experiencing in trying to reach a personally important goal. This task is based on a broader conceptualisation of rumination compared to those that focus on the maladaptive consequences of rumination as a response primarily to negative mood, such as the Response Styles Theory (RST; Nolen-Hoeksema, 1991). RST argues that that rumination maintains existing depressive mood. If rumination is responsible for the onset of depression, it is because it keeps perpetuating what would otherwise be a transient normal sad mood (Lyubomirsky & Nolen-Hoeksema, 1993). In this context, rumination is almost always regarded as a maladaptive response style. In contrast, Goal theory posits that an inward focus isn’t necessarily maladaptive, and that rumination can be functional (Martin & Tesser, 1996). Specifically, it is argued that environmental discrepancies turn the individual’s attention inwards so that they can focus on the problem at hand. This notion is consistent with previous research which demonstrates that people who ruminate do so because they believe that it aids insight and
understanding into situations (Kingston, Watkins & O’Mahen, 2013). Crucially, it may be the way that an individual focusses on a problem that leads to positive or negative outcomes. The induction task in this study encouraged abstract, unhelpful rumination (for example, by asking participants to “focus on how this problem or difficulty bothers and troubles you”). The results of the current study suggest that this type of rumination in particular has a negative impact on maternal behaviours, regardless of depressive symptoms.

Together, the results of this study highlight the specific negative consequences of ruminative thought on the quality of mother-infant interactions. The causal relationship between rumination and mother-infant interaction found in this study replicate and extend findings from existing cross sectional and experimental studies. For example, brooding rumination has been implicated in correlational studies that highlight self-reported impairments in both maternal bonding (Muller et al., 2012) and maternal responsiveness (Tester-Jones et al., unpublished manuscript). Further, in a recent experimental study of rumination and mother-infant interaction Stein et al. (2012) demonstrated a trend of reduced responsiveness to infant vocalization in mothers with depression. The results of the present study confirm a causal relationship between rumination and mother-infant interaction quality, but are not able to demonstrate this effect occurs more strongly in mothers with depressive symptoms compared to those without.

6.6.2 Maternal control and maternal unresponsiveness

Contrary to our hypothesis, there was not an effect of rumination on unresponsive or controlling behaviours. However, for both of these measures a main effect of group was found. For unresponsiveness, this demonstrated that mothers in the dysphoric group exhibited more unresponsiveness behaviours overall compared to the
non-dysphoric group. However, an unexpected pattern of results was observed for the measure of maternal control. Maternal controlling scores were significantly higher for the non-dysphoric, compared to the dysphoric group. Furthermore, when examining differences in control scores at each time point, there is a marginally significant difference at time 3 (following the still face situation), that is not found at time 1 or time 2. Control is an active, rather than passive behaviour. These findings suggest that for non-dysphoric mothers, the reduced sensitivity that is prompted by a stressful situation (i.e. the still face situation) may be expressed in a more active, controlling manner. In contrast, for dysphoric mothers the stressful situation appears to have a more passive effect, reducing active controlling behaviours after the still-face situation rather than increasing them. This notion is further supported by the finding that overall, dysphoric mothers exhibited more unresponsive, passive behaviours compared to non-dysphoric mothers in this study. This finding is also consistent with literature on approach and avoidance in depression, which demonstrates that individuals with depression exhibit greater levels of avoidance and withdrawal and lower levels of approach (Ottenbright, Dobson & Quigley, 2014; Dickson & McLeod, 2004). Mothers experiencing depressive symptoms also exhibit more avoidant and withdrawn behaviours when interacting with their infants (Malphurs et al., 1996).

6.6.4 Limitations

This study found main effects of both rumination and mood on the quality of mother-infant interactions. Future research should consider an induction based on control theory, but that is also designed to focus on the maladaptive consequences of rumination as a response to negative mood in order to unpack the effects of rumination on dysphoric compared to non-dysphoric mothers.
Second, due to a technical error and subsequent loss of data, we were not able to analyse current mood post rumination induction. However, previous research in this area has been criticized for relying primarily on a post-mood rumination induction. As such manipulation checks render it unclear whether subsequent outcomes are due to changes in mood associated with rumination or due to changes in ruminative behaviour. This study directly assessed analytical thinking and showed that individuals in the rumination condition had more analytic thinking than individuals in the control condition.

Third, in order to reduce the burden of participation on a mother with a young infant, each participant was given the option of taking part in the experiment either in their own home, or at the university. This may have impacted on the level of control the experimenter had over external conditions. However, we conducted sub-analyses to check whether patterns of outcomes differed significantly between those who completed the task at home or in the lab, and did not find any differences.

Fourth, this study used a sample of dysphoric mothers, as opposed to a clinical diagnosis of postnatal depression. Future research should attempt to replicate these results with mothers who meet the diagnostic criteria for depression. It will be important in future studies to also address the lack of diversity with a broader sample of mothers from different cultural and socioeconomic backgrounds.

6.6.5 Conclusions

In conclusion, this study demonstrated that a self-relevant rumination induction played a causal role in disturbances in mother-infant interaction quality, reducing sensitive behaviour and dyadic synchrony between mother and infant, and increasing maternal controlling behaviours. Consistent with previous literature, this study also demonstrated significant differences in interaction quality between dysphoric and non-
dysphoric mothers. However, we did not find differential effects of rumination on sensitivity and dyadic synchrony in dysphoric compared to non-dysphoric mothers. These findings are of note because they demonstrate a causal role for rumination in the way a mother interacts with her infant, suggesting that negative effects on mother-infant interaction quality may be a result of increased ruminative thinking and a narrowed self-focus. This study builds on our understanding about how specific cognitive processes such as rumination are causally implicated the mother’s ability to sensitively respond to her infant. Clinically, the results of this study highlight the potential importance of targeting the role of ruminative thinking in parenting programmes aimed at improving mother-infant interaction and maternal sensitive responding.
6.7 Appendix A: A priori power analysis

Prior to data collection for the study an a priori power analysis was carried out using G* Power in order to estimate the number of participants required to minimize the risk of type II error. The following assumptions were applied; medium effect size (Cohen, 1988; \( f^2 = .40 \)), \( \alpha = .05 \), \( \beta = .80 \), four variables being tested and four independent variables in total. It was estimated from this power analysis that 80 participants were required. (Figure 6.5). Following recruitment deadlines this study subsequently recruited 79 participants in total after the final participant dropped out.

Figure 6.5
Power analysis
An important assumption of ANOVA is that the response variable residuals are normally distributed. As such, while it is not necessary for variables to be normally distributed, skewed data may be problematic if it results in cases with large residuals (>3). Maternal controlling scores demonstrated substantial positive skewness at baseline (T1, z skewness = 1.21, z kurtosis = 1.04) post induction (T2, z skewness = 1.21, z kurtosis = .96) and post still-face situation (T3, z skewness = .86, z kurtosis = -.46). Log transformations were used to address this issue and normalize this variable at T1; z skewness = .13, z kurtosis = -1.21, T2; z skewness = -.13, z kurtosis = -.88 and T3; z skewness = -.06, z kurtosis = -1.25. The log transformed data was approximately symmetric, but was slightly platykurtic at T2 and T3 (Figures 6.6 to 6.8).

**Figure 6.6**
Distribution of T1 maternal control before (left) and after (right) Log transformation
Figure 6.7
Distribution of T2 maternal control before (left) and after (right) Log transformation

Figure 6.8
Distribution of T3 maternal control before (left) and after (right) Log transformation
6.9 Appendix C: A preliminary exploration of the causal role of experimentally induced rumination on attentional disengagement from infant stimuli.

This appendix provides a brief report of the methods and results of an additional task that was run with this sample as a preliminary exploration of the causal role of experimentally induced rumination on attentional disengagement from infant stimuli in dysphoric compared to non-dysphoric mothers. Research examining the role of attentional bias in the context of postnatal depressive symptoms is sparse, with initial research in this area demonstrating patterns of behaviour in mothers and pregnant women contrary to the general adult depression literature. Specifically, research has found that mothers show preferential processing of infant distress compared to non-mothers (Seifritz et al., 2003). In comparison, depressed pregnant women have been found to disengage attention more quickly from distressed compared with non-distressed infant faces, demonstrating a diminished attentional bias towards infants with distressed faces (Pearson et al., 2010). This is in contrast to the adult depression literature, which largely demonstrates an attentional bias towards mood congruent information (for a review see Peckham, McHugh & Otto, 2010. Other research suggests that rumination may exacerbate the effects of depression on attention bias (e.g. Donaldson, Lam & Matthews, 2007; for a discussion see section 2.4.1). Thus, this task was included in the study in order to attempt to replicate the findings of Pearson and colleagues with a postnatal sample, and to explore the role of rumination in attention disengagement.

Method

Attention task The task was carried out following the procedures detailed in the main body of this chapter, but prior to debriefing. Following the completion of the
second play interaction task, participants were given a five minute break. Participants then completed the rumination induction task again, followed by an attention task which has been specifically designed to look at the ability of stimuli to retain attention. The experimenter cared for the infant in an adjacent room for the duration of this task in order to avoid distractions. A modified version (Pearson et al., 2010) of an established paradigm (Bindermann et al., 2005) was used to measure the participants ability to disengage attention from infant and adult faces displaying negative, positive and neutral emotions (Pearson et al., 2010).

The task was approximately seven minutes long and generated using e Prime software. Participants focused on a central go/no-go signal (a green or red cross respectively) on the computer screen. Two lines, one horizontal and one vertical were also shown at the screen’s periphery. A red central cross signified a no-go task and upon seeing a red cross the participant was instructed to ignore all other stimuli and push the space bar. A green cross signified a go trial. If a green cross was displayed, participants were required to make a localization judgment as to which side of the screen the vertical line was seen (the ‘A’ key for ‘left’ of the screen, and ‘L’ key for ‘right’ of the screen). In order to do this, the participant was required to disengage their attention from the central go signal to a peripheral line target. If stimuli projected on screen behind the cross retains the individual’s attention it will take them longer to disengage their attention from the centre and locate the peripheral target. Therefore response times may be slowed by the presence of specific stimuli behind the go/no-go signal. In this task fearful, happy or neutral adult and distressed, happy or neutral infant faces appeared behind the cross. Each trial began with a black fixation cross (750ms) followed by the stimulus display (240ms, which includes the central go/no-go signal, the stimulus face and the two peripheral lines), and then finally a blank screen until a response is registered (the ‘space bar’, ‘A’ key or ‘L’ key).
Participants practiced for 36 trials with no images behind the go/no-go signals, and 21 trials with adult and infant faces included. Participants were required to reach a 70% or greater success rate on the practice trial before continuing to the test trials, in order to ensure that they could complete the task effectively. Then 6 blocks of 30 trials (20 go and 10 no-go) one for each face type condition, were used and participants response times were be recorded. After each block there was a short rest period. At the end of the task, an on screen message indicated the end of the experiment, and the participant was instructed to inform the experimenter.

Data analysis

The dependent measure for analysis was reaction time (ms) on accurate go trials. To investigate the influence of infant distress on reaction times and how this was affected by depressive symptoms and the induction task, a 2 (dysphoric or non-dysphoric) by 2 (rumination or control) ANOVA was conducted. The analysis was conducted for infant stimuli only. In accord with the findings of Pearson and colleagues, we predicted that dysphoric symptoms would be associated with a diminished attentional bias towards distressed infant faces. We further hypothesised that rumination would exacerbate the effects of the dysphoric symptoms, leading to faster reaction times in the dysphoric/rumination group compared to the non-dysphoric rumination group and dysphoric and non-dysphoric mothers in the control condition.

An attentional bias to infant distress was defined as longer reaction times on trials when distressed infant faces appeared compared with trials where non-distressed infant faces appeared. In order to examine the effects of infant distress compared to non-distress, mean reaction times to infant happy and infant neutral faces (Table 6.3) were collapsed. The difference between mean reaction times (ms) on distressed and non-distressed infant trials was then computed for each individual in order to obtain a measure of the degree of attentional bias towards distressed infant faces. Positive scores
indicate slower disengagement from infant distress while negative scores indicate a bias away from infant distress. Reaction times to infant distressed and non-distressed infant faces were checked for normal distribution, and reaction times above or below 3 standard deviations of the group mean were removed from the analysis ($N = 1$).

**Results**

*The effect of mood and induction type on reaction times to distressed infant faces* A 2 (group; dysphoric or non-dysphoric) x 2 (induction type; rumination or control) ANOVA was conducted to investigate the effect of group and induction type on reaction times to distressed infant faces. Contrary to predictions, no main effect of group, $F (1, 76) = .69, p = .41$, or induction type, $F (1, 76) = .28, p = .59$, was found, and rumination did not moderate the relationship between dysphoric mood and reaction time to distressed infant faces, $F (1, 76) = .08, p = .78$.

An examination of group mean reaction times revealed that whilst the dysphoric/rumination group did not react significantly faster to distressed infant faces ($M = -29, SD = .64.14$) compared to the dysphoric/control group ($M = 9.70, SD = 57.86$), or the non-dysphoric mothers in either the rumination ($M = 13.38, SD = 45.30$) or control ($M = 16.35, SD = 43.86$) condition, $t (73) = -.93, p = .35$, a non-significant trend was apparent. This suggests that mothers in the dysphoric/rumination group do demonstrate a bias away from infant distress that does not reach significance, compared to the slower disengagement observed in the other three groups. Thus it is possible that these findings reflect a small sample size and a fully powered study may detect significant effects.
Table 6.3

Means (SD) for reaction times to distressed, happy and neutral infant faces on go trials by group and induction type.

<table>
<thead>
<tr>
<th>Block Type</th>
<th>Group</th>
<th>Reaction time (ms)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distressed infant</td>
<td>Dysphoric/control</td>
<td>619.62</td>
<td>84.92</td>
</tr>
<tr>
<td></td>
<td>Dysphoric/rumination</td>
<td>633.13</td>
<td>106.48</td>
</tr>
<tr>
<td></td>
<td>Non-dysphoric/control</td>
<td>650.96</td>
<td>94.00</td>
</tr>
<tr>
<td></td>
<td>Non-dysphoric/rumination</td>
<td>662.71</td>
<td>103.02</td>
</tr>
<tr>
<td>Happy Infant</td>
<td>Dysphoric/control</td>
<td>612.57</td>
<td>88.31</td>
</tr>
<tr>
<td></td>
<td>Dysphoric/rumination</td>
<td>639.59</td>
<td>90.38</td>
</tr>
<tr>
<td></td>
<td>Non-dysphoric/control</td>
<td>631.14</td>
<td>85.78</td>
</tr>
<tr>
<td></td>
<td>Non-dysphoric/rumination</td>
<td>632.23</td>
<td>86.49</td>
</tr>
<tr>
<td>Neutral infant</td>
<td>Dysphoric/control</td>
<td>607.35</td>
<td>109.95</td>
</tr>
<tr>
<td></td>
<td>Dysphoric/rumination</td>
<td>627.26</td>
<td>103.46</td>
</tr>
<tr>
<td></td>
<td>Non-dysphoric/control</td>
<td>638.07</td>
<td>80.41</td>
</tr>
<tr>
<td></td>
<td>Non-dysphoric/rumination</td>
<td>642.55</td>
<td>102.76</td>
</tr>
</tbody>
</table>
Additional analyses were run, repeating the procedures reported in the main body of this chapter, whilst also controlling for trait rumination (RRS). The results of these analyses are reported below.

**Observational Mother-infant interactions**

*Effects of ruminative thinking on dyadic synchrony.* A 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA was used to analyse global dyadic synchrony scale scores. A significant main effect of group, $F(1, 74) = 15.18, p < .001$, reflected a lower DSS score overall in dysphoric ($M = 6.98, SD = 1.48$) compared to non-dysphoric ($M = 8.32, SD = 1.54$) mother-infant dyads. No main effect of induction type was found, $F(1, 74) = 3.42, p = .06$. However, a main effect of time, $F(2,148) = 7.07, p = .001$, demonstrates significant differences in dyadic synchrony across time. This was qualified with t-tests, demonstrating significant differences between T1 and T2 ($t(76) = -2.54, p = .01$), and T1 and T3 ($t(75) = -3.32, p = .001$).

As predicted, there was also significant two way time x induction type interaction on DSS scores, $F(1, 78) = 4.97, p = .008$. A one way repeated measures ANOVA confirmed a significant effect of time in the rumination, $F(2,74) = 13.54, p < .001$, but not distraction condition, $F(2,74) = .12, p = .88$. To unpack this relationship, we conducted t-tests to explore the effect of time in the rumination condition. There was a significant decrease in dyadic synchrony between T1 and T2, $t(37) = -3.52, p = .001$ ($M = -1.32, SD = 2.30$), but no significant change between T2 and T3, $t(37) = -1.39, p = .17$ ($M = -.34, SD = 1.51$; Figure 6.9). We conducted tests of simple main effects for group comparisons (Howell, 2002) to compare differences in DSS scores at each time point in between the rumination and distraction conditions. No significant differences
were observed in DSS scores at T1, $F (1, 78) = 5.19, p = .26$, T2, $F (1, 78) = 35.35, p = .11$ or T3, $F (1, 78) = 60.23, p = .08$ (Table 6.4).
Table 6.4

Means (SD’s) of DSS and maternal sensitivity by condition for each time point.

<table>
<thead>
<tr>
<th>Condition</th>
<th>DSS</th>
<th>Maternal sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
</tr>
<tr>
<td>Rumination</td>
<td>8.36 (2.57)</td>
<td>7.05 (1.85)</td>
</tr>
<tr>
<td>Control</td>
<td>8.05 (1.95)</td>
<td>7.92 (2.22)</td>
</tr>
</tbody>
</table>

Notes: DSS = Dyadic Synchrony Scale; T = Time
Figure 6.9

Estimated marginal means for Dyadic Synchrony in the rumination and distraction conditions across time points

![Graph showing Dyadic Synchrony over time for rumination and distraction conditions]

Effects of ruminative thinking on maternal sensitivity. A second 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA was used to analyse ratings of maternal sensitivity. A significant main effect of group, $F(1, 74) = 19.60, p < .001$, again reflected lower overall sensitivity in dysphoric ($M = 6.29, SD = 2.75$) compared to non-dysphoric ($M = 8.77, SD = 2.08$) mother infant dyads. No main effect of induction type was found, $F(1, 74) = 2.33, p = .13$, but again a main effect of time was observed, $F(2,148) = 12.63, p < .001$, demonstrating that maternal sensitivity changed across time. Further analysis revealed significant reductions in sensitivity between (1) T1 and T2, $t(76) = -1.98, p = .05$ (2) T1 and T3, $t(75) = -4.24, p < .001$ and (3) T2 and T3, $t(76) = -3.47, p = .001$. 

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The main effect of time was qualified by a significant two way time x induction type interaction on maternal sensitivity, $F(1, 74) = 4.08, p = .01$. To explicate this interaction, we conducted a one-way repeated measures ANOVA of time within induction type. There was a significant effect of time in the rumination, $F(2,74) = 17.48, p < .001$, but not distraction condition, $F(2,78) = 1.19, p = .31$. We conducted t-tests to further unpack where significant change occurred within the rumination condition (Figure 2). A significant decrease was observed in maternal sensitivity between T1 and T2, $t(37) = -2.84, p = .007$ ($M = -1.36, SD = 2.96$) and T2 and T3, $t(37) = -3.75, p = .001$ ($M = -1.65, SD = 2.72$). Again tests of simple main effects for group comparisons were conducted to compare differences in sensitivity scores at each time point in both the rumination and distraction conditions. Significant differences were found at T2, $F(1, 78) = 25.91, p = .04$, and T3, $F(1, 78) = 155.07, p = .006$, but not at T1, $F(1, 78) = 10.67, p = .08$ (Table 6.4).

*Figure 6.10*

Estimated marginal means for maternal sensitivity in the rumination and distraction conditions across time points
Effects of ruminative thinking on maternal unresponsiveness. Maternal unresponsiveness was analysed with a 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA. There was a significant main effect of group, $F(1, 74) = 33.54, p < .001$; dysphoric mothers had higher unresponsiveness scores ($M = 5.12, SD = 3.28$) compared to non-dysphoric ($M = 1.80, SD = 1.74$) mothers. No main effect of induction type, $F(1, 74) = .08, p = .79$, or time was found, $F(2, 148) = .67, p = .51$, demonstrating that overall, mean unresponsiveness scores were not significantly different between induction types and did not significantly change over time.

Contrary to predictions, a time by induction type interaction was not found, $F(1, 74) = .596, p = .55$. However, there was a significant two-way time x group interaction, $F(1, 74) = 3.71, p = .02$. A one-way repeated measures ANOVA demonstrated no significant overall effect of time in the dysphoric, $F(1, 74) = 2.39, p = .09$ or non-dysphoric group, $F(1, 78) = 1.72, p = .19$, although t-tests revealed a significant increase in unresponsiveness between T2 and T3 in the dysphoric group, $t(35) = 2.12, p = .04$ ($M = 1.16, SD = 3.36$), but not in the non-dysphoric group, $t(37) = -1.16, p = .25$ ($M = -0.40, SD = 2.17$; Figure 3). No other main effects or interactions were found.

Effects of ruminative thinking on maternal control. A 2 (group: dysphoric or non-dysphoric) x 2 (induction type: rumination or distraction) x 3 (time: T1 baseline, T2 post induction and T3 post still face) mixed ANOVA was used to analyse maternal controlling scores. There was no main effect of group, $F(1, 74) = 1.65, p = .20$, induction type, $F(1, 74) = 3.03, p = .09$, or time, $F(2, 148) = 2.75, p = .07$. No two way time x group, $F(2, 148) = .47, p = .62$, or time by induction type, $F(2, 148) = .72, p = .49$, interactions were found. There was also no significant three way time x group x induction type interaction on controlling scores, $F(2, 148) = .28, p = .75$. 
Figure 6.11

Estimated marginal means for maternal unresponsiveness in the dysphoric and non-dysphoric conditions across time points
CHAPTER 7: General Discussion

The principal aim of this thesis was to increase understanding of the relationship between postnatal depressive symptoms and maternal sensitivity, and the role rumination has within this relationship. Analyses using prospective, daily diary and experimental strategies were reported from both community and clinical samples. In the following chapter I will provide an overview and discussion of the thesis findings with reference to the thesis hypotheses and proposed thesis model (Figure 2.2) presented in Chapter 2 (sections 2.6 and 2.7). I will also present a revised thesis model, incorporating and integrating the thesis findings (Figure 7.1). Finally, I will discuss the implications of these findings for existing theoretical models of rumination, and for clinical practise in a postnatal context.
Figure 7.1

Hypothesised (a) and revised (b) thesis models

(a)

Infant temperament

Social support

Ruminative response style

Maternal Depressive symptoms

Maternal Attunement

(b)

Infant temperament

Social support

Ruminative response style

Maternal Depressive symptoms

Maternal Attunement

Child outcomes

Note: Bold lines indicate supported thesis hypotheses. Dashed lines indicate that the direct relationship is mediated by another variable. Grey lines in model (b) indicate relationships that were not supported by the thesis findings.
7.1 Summary of thesis findings

The following section provides an overview of the thesis hypotheses and the key results from the studies conducted.

7.1.1 Hypothesis 1: Rumination is associated with impairments in maternal attunement, and mediates the effect of depressive symptoms on maternal attunement

Hypothesis one was built on evidence which demonstrated 1) that rumination is associated with depressive symptoms both in the adult depression and maternal depression literature (e.g. Nolen-Hoeksema, Larson and Grayson, 1999; Nolen-Hoeksema and Morrow, 1991; Barnum, Woody and Gibb, 2003), 2) there is an association between rumination and maternal attunement in the perinatal period (Müller et al., 2013) and 3) growing evidence of the relationship between rumination and other key cognitive and behavioural parenting mechanisms (e.g. Pearson et al., 2010; O’ Mahen et al., 2013). Subsequently, the first thesis hypothesis was that a concurrent association would exist between rumination and maternal attunement, specifically in the postnatal period, and that rumination would mediate the effect of depressive symptoms in the postnatal period on poorer maternal attunement. Maternal attunement was operationalized predominantly using trait measures of maternal responsiveness (MIRI; Amankwaa, Pickler and Boonmee, 2007) and maternal bonding (PBQ; Brockington et al., 2001).

This hypothesis was tested in study one of this thesis, using self-report questionnaire data collected online from a community sample of 203 mothers with infants aged between nine and 14 months old. To test hypothesis one, two Structural Equation Models (SEM) were estimated for both perceived maternal responsiveness and maternal bonding. In the first model, maternal responsiveness was the outcome variable and
depressive symptoms and brooding rumination were the predictors (to test thesis hypothesis three, social support was also included as a predictor, with infant negative affect temperament as a moderator of the entire model). As predicted, brooding rumination was associated with maternal responsiveness, and fully mediated the relationship between depressive symptoms and maternal responsiveness. Contrary to expectations however, this relationship was only significant when infant negative affect temperament was low; thus, infant temperament moderated the relationship between maternal depressive symptoms, brooding rumination and maternal responsiveness. When infant negative temperament was high, depressive symptoms were associated with both maternal rumination and maternal responsiveness, but rumination did not mediate the effect of depressive symptoms on responsiveness.

A second Structural Equation Model was estimated in which maternal bonding was the criterion variable and brooding rumination and depressive symptoms as the predictors. In contrast to the findings with maternal responsiveness, there was not a significant relationship between maternal bonding and brooding rumination at either high or low levels of negative infant temperament. Mediation requires a significant relationship between the mediator and the outcome variable (Baron and Kenny, 1986). Thus, it was possible to conclude that the effect of maternal depressive symptoms on perceived maternal bonding was not mediated by brooding rumination in this study.

The finding with maternal responsiveness was subsequently replicated with a separate community sample ($N = 94$) of mothers with infants aged between 3 and 14 months (study 3). That study examined the state relationships between attunement and rumination in a daily diary study. In this study, state rumination was operationalized using a three item scale to assess key elements of a ruminative, self-focussed thinking style, and maternal mood and perceived bonding were assessed using a single item, 10 point Likert
scale for each. Consistent with the findings of study 1, state rumination was concurrently associated with a state measure of felt closeness with infant (bonding), and mediated the relationship between state mood and state bonding. Thus, the findings from two separate samples both demonstrated support for hypothesis 1, with each study tapping into different aspects of the mother-infant relationship. These results demonstrated that an association exists between rumination and maternal attunement in the postnatal period, and that rumination mediated the effect of depressive symptoms in the postnatal period on both state and trait measures of perceived poorer maternal attunement. It is noteworthy that in study 1, rumination was associated with dispositional measures of maternal responsiveness, but not bonding. In contrast, study 3 revealed that rumination was associated with a state measure of bonding. Rumination was also measured differently in each of these studies. Study 1 assessed rumination using the Response Styles Questionnaire, based on Nolen-Hoeksema’s (1991) Response Styles Theory, whilst study 3 tapped into three important aspects of ruminative thought; the extent to which participants were: focusing on their emotions, focusing on analysing and understanding things, and focusing on evaluating things. Thus there is the caveat that the relationship between rumination, depressive symptoms and maternal attunement is qualified both by the type of attunement measured, and how rumination is assessed. Study 1 also indicates that these relationships may also be qualified by infant temperament.

7.1.2 Hypothesis 2: The role of contextual and infant factors; rumination will mediate the effect of social support on maternal attunement, and infant temperament will moderate the hypothesised thesis model.

Thesis hypothesis 2 draws on literature which suggests that difficult infant temperament can be particularly problematic for maternal attunement when the mother is
also suffering with postnatal depression (e.g. Pauli-Pott et al. 2000), therefore potentially creating particular parenting contexts in which rumination is more likely to occur. Further, it was found that social support prospectively buffers the effects of rumination on depressed mood (O’Mahen et al. 2010). Thus, the second thesis hypothesis was that rumination would mediate the effect of depressive symptoms on maternal attunement when infant temperament (operationalised using the Infant Behaviour Questionnaire: revised; IBQr, Gartstein & Rothbart, 2003) is perceived to be more negative. It was further hypothesised that rumination would mediate the effect of social support (operationalised using the Social Provisions Scale; SPS, Cutrona & Russell, 1987) on maternal attunement when infant temperament was perceived to be more negative.

This hypothesis was tested in study 1 using two Structural Equation Models to examine the relationship between rumination and social support with both perceived maternal responsiveness and maternal bonding. In the first model, maternal responsiveness was the outcome variable and depressive symptoms, brooding rumination and social support were the predictors, with infant negative affect temperament as a moderator of the entire model. In partial support of thesis hypothesis 3, infant temperament moderated the relationship between depressive symptoms, brooding rumination and maternal responsiveness when negative affect in the infant was perceived to be low, not high. This finding was not replicated with maternal bonding. Additionally, in the context of having an infant with a more difficult temperament, perceived maternal responsiveness was poorer when the mother reported feeling less supported. However, contrary to predictions, rumination did not mediate the effect of social support on maternal responsiveness; social support was not significantly associated with brooding rumination at either high or low levels of negative infant temperament. In the second model, maternal bonding replaced maternal responsiveness as the criterion variable. In this model, social support was not
associated with rumination, and neither social support nor rumination were associated with maternal bonding.

7.1.3 Hypothesis 3: Rumination in the context of maternal depressive symptoms causes impairments in maternal attunement

Rumination has been conceptualised as a self-focussing, avoidant coping style (Watkins & Moulds, 2004; Moulds, et al., 2007). This, coupled with emerging empirical findings in the adult depression literature and the perinatal literature suggest that ruminative thinking may adversely affect perceived maternal attunement via impairment of key cognitive and behavioural parenting related mechanisms (e.g. attention, interpersonal problem solving). Thus, the third thesis hypothesis was that rumination would predict impairments in maternal attunement, and that the relationship between rumination and attunement would be moderated by depressive symptoms. Specifically, we expected the relationship to be significant when depressive symptoms were high, but not low.

This hypothesis was tested initially in study 2 of this thesis by examining the prospective relationship between rumination and attunement. Study 2 comprised a follow up assessment point approximately six months after the baseline assessment that formed the results of study 1, allowing for an examination of the prospective relationship between the primary study variables. A series of Hierarchical Linear Regression models examined the interactive effects of depressive symptoms, as assessed using the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden & Sagovsky, 1987) and rumination, assessed using the Response Styles Questionnaire-revised (RRS; Nolen-Hoeksema & Morrow, 1991; Treynor et al., 2003) on attunement, assessed using the Postpartum Bonding Questionnaire (PBQ; Brockington et al., 2001). Baseline depressive symptoms and baseline rumination
(and their interaction term) were the predictor variables, and attunement at the six month follow up was the criterion variable.

The results of study 2 were partially consistent with thesis hypothesis 3. As expected, there was a prospective relationship between rumination and attunement that was moderated by depressive symptoms. However, contrary to predictions, this relationship was not in the expected direction. Rumination did not prospectively predict maternal attunement. Instead, poorer maternal attunement at baseline predicted increased rumination at the follow up. Further, depressive symptoms moderated this relationship such that poor attunement predicted increases in rumination when depressive symptoms were low, not high.

Study 3 also aimed to test thesis hypothesis 2, examining state, rather than dispositional rumination using daily diary data. In study 3, a series of Hierarchical Linear Models (HLM) were used to test the mediational relationship between rumination, attunement and mood. Consistent with the findings of study 2, but in contrast to thesis hypothesis 2, perceived bonding with infant on day one predicted self-reported maternal mood on day two, and this relationship was mediated by ruminative thinking on day 2. Again, these results did not demonstrate that rumination impacted on bonding. An additional novel finding of study 3 was that attunement with infant (operationalised via an indication of felt closeness) was not stable across time. Rather, study 3 highlights that it is not always consistent within individuals, and is therefore fluctuating and context dependent. This finding is important, because it suggests that maternal bonding with infant can be influenced by daily situations and contexts, and may be shaped by a number of potential factors, increasing and decreasing as feelings or problems become more or less salient, much in the same way that rumination is affected moment by moment (Moberley & Watkins, 2008).
Finally, because demonstrating prospective and daily relationships alone using self-report measures does not adequately infer causality, and only allows us to test perceptions of maternal attunement, thesis hypothesis 2 was also tested using experimental methodology to examine whether differences in a mother’s behaviour when interacting with her infant can be attributed to change in rumination. In study 4 ($N=79$), rumination was manipulated in dysphoric and non-dysphoric mothers with infants aged three to 12 months old using a goal cueing task, and maternal attunement was operationalised using an objective measure of maternal behaviour while interacting with her infant in a free play task (CARE Index; Crittenden, 2003). Partially consistent with thesis hypothesis 2, mothers in the rumination condition demonstrated reduced dyadic synchrony and maternal sensitivity compared to those in the control condition. However, this effect was not moderated by dysphoric symptoms, and no effects of rumination were found on unresponsive or controlling behaviours. Rather, a main effect of mood was found with these behaviours. Whilst it is difficult to offer a clear explanation as to why effects of rumination were not found on these behaviours, it is possible to speculate that different mechanisms may be acting on maternal unresponsive and controlling behaviours, rather than ruminative thinking as hypothesised.

In sum, partial support was found for the hypothesis that rumination causes impairments in maternal attunement, and that the relationship between rumination and attunement is moderated by depressive symptoms. Studies 2 and 3 demonstrate that poorer attunement is an antecedent of increased rumination when depressive symptoms are low, not high, as opposed to the hypothesised relationship wherein increased rumination predicts poorer attunement when depressive symptoms are high. In contrast, study 4 uses an experimental methodology to demonstrate that an induced state of ruminative thinking
causes impairments in maternal interaction behaviours with her infant, but this effect is not moderated by dysphoric symptoms.

7.1.4 Hypothesis 4: Ruminition causes impairments in maternal attentional disengagement with distressed infant emotion

Drawing on recent evidence showing that depressed pregnant women demonstrate a diminished attentional bias towards infants with distressed faces (Pearson, Cooper & Penton-Voak et al., 2009), and other research demonstrating that rumination may exacerbate the effects of depression on attention bias (e.g. Donaldson, Lam & Matthews, 2007), it was further hypothesized that mothers induced to ruminate would demonstrate an attentional bias away from infant distressed emotion, and that the effect of rumination on attentional bias would be moderated by depressive symptoms (Chapter 6, study 4; Appendix C).

This hypothesis was tested in an additional task that was run with the sample recruited in study 4 as a preliminary exploration of the causal role of experimentally induced rumination on attentional disengagement from infant stimuli. Following the main procedures described in Chapter 6, rumination was manipulated in dysphoric and non-dysphoric mothers with infants aged three to 12 months old using a goal cueing task, and maternal attentional bias was operationalized using a modified version (Pearson et al., 2009) of an established paradigm (Bindermann et al., 2005) to measure participants’ ability to disengage attention from infant and adult faces displaying negative, positive and neutral emotions. The dependent measure for analysis was reaction time (ms) on accurate go trials and the independent variables were mood (dysphoric or non-dysphoric) and induction type (rumination or control). Contrary to predictions, no main effect of group or induction type was found, and rumination did not moderate the relationship between dysphoric mood and
reaction time to distressed infant faces. Thus, the hypothesis that mothers induced to ruminate would demonstrate an attentional bias away from infant distressed emotion, and that the effect of rumination on attentional bias would be moderated by depressive symptoms was not supported. However, an observed trend in means suggests that mothers in the dysphoric/rumination group did demonstrate a bias away from infant distress that did not reach significance, compared to the slower disengagement observed in the control group, and in non-dysphoric mothers. As such it is possible that these findings reflect a small sample size and a fully powered study may detect significant effects.

7.1.5 **Hypothesis 5: Impairments in maternal attunement in the context of maternal depressive symptoms cause more rumination.**

Drawing on Goal Theory of rumination (Martin et al., 1993), it was predicted that environmental discrepancies in a parenting context (such as difficulties in bonding with infant) may also result in more rumination. Consequently, the fifth hypothesis of this thesis was that impairments in maternal attunement in the context of maternal depressive symptoms would predict more rumination. This hypothesis was tested in studies 2 and 3 of this thesis, both prospectively (study 2), and in a state (i.e., non-dispositional), daily diary context (study 3). As predicted, study 2 demonstrated that poorer maternal attunement at baseline predicted increased rumination at the six month follow up. Furthermore, rumination did not prospectively predict maternal attunement, suggesting a unidirectional relationship. Similarly, study 3 replicated this finding using state measures of rumination and attunement. Specifically, perceived bonding with infant on day one predicted self-reported maternal mood on day two, and this relationship was mediated by ruminative thinking on day 2. Again, study 3 failed to demonstrate that rumination was predictive of changes in maternal attunement.
To summarise, the findings of this thesis inform a revised thesis model (Figure 7.1). This model proposes that the relationship between maternal rumination and maternal attunement is potentially bidirectional; self-reported perceptions of attunement predicted increased rumination, whilst rumination also adversely impacted maternal behaviours when interacting with her infant. The revised thesis model also indicates that the effect of attunement on rumination is moderated by depressive symptoms. This is in contrast to the proposed thesis model, which hypothesised that depressive symptoms would moderate the effect of rumination on maternal attunement. The revised thesis model also presents direct relationships between 1) depressive symptoms and maternal attunement, and 2) rumination and attunement. Furthermore, the revised model indicates that rumination mediates the effect of attunement on depressive symptoms, whilst the proposed model suggested that rumination would mediate the effect of depressive symptoms on attunement. Finally, the revised model presents direct relationships between social support and depressive symptoms, and social support and attunement. However, social support is not directly associated with rumination, and rumination does not mediate the effect of social support on attunement, as was hypothesised in the proposed thesis model.

7.2 Discussion of thesis findings

The following section will consider the thesis findings and the revised thesis model (Figure 7.1) in light of existing empirical evidence and theories of rumination discussed in the literature review and the implications of the thesis findings for the application of these theories in a postnatal context.
7.2.1 Rumination as a state of 'preoccupation'

Recent reviews of the literature and supporting empirical evidence suggest that rumination in the context of psychopathology plays a role in reducing attention and responsivity to the environment. In a postnatal context this may lead to the mother being ‘preoccupied’, defined as “a state of narrowed or self-focused attention in which one's mind is dominated by recurrent negative intrusive thoughts that are difficult to control, difficult to dismiss and recur even if dismissed” (Stein et al., 2008 p2). Stein and colleagues argue that preoccupation results in the mother being less able to be responsive to the infant’s social and emotional needs. In support of this notion and previous empirical findings that implicate rumination in deficits in a number of aspects of cognitive functioning and behaviour, this thesis demonstrated that a direct experimental manipulation of ruminative thinking reduced sensitive maternal behaviours towards her infant, as well as the dyadic synchrony between mother and infant during a play interaction task. Moreover, mothers who completed the rumination induction also reported greater levels of analytical thinking immediately afterwards, further supporting the notion of a narrowed state of attention that was focused on understanding, explaining and making sense of things during the play interaction task with their infant. Thus, Study 4 of this thesis provides support for the idea that maternal rumination that is focused internally can negatively affect the mother’s ability to respond sensitively to the infant. Notably, however, rumination was not moderated by maternal depressive symptoms in this study. This is in contrast to previous experimental studies of rumination, which have typically found that depressive symptoms interacted with ruminative style to predict negative emotional and interpersonal outcomes (e.g. Lo, Ho & Hollon, 2010). These results are also different than those found in a similar study by Stein and colleagues. Stein et al (2012) found a trend towards decreased vocalisations when interacting with their infant in clinically depressed mothers induced to ruminate. The
finding in study 4 that depressive symptoms did not moderate the effect of rumination on maternal behaviours is of particular note. It is worth considering that we might not expect to find an interaction between dysphoric symptoms and rumination due to the nature of the rumination induction task used, which differed from Stein and Colleagues’ task. The goal cueing task used in study 4 (see section 6.4.2 for an overview) asked mothers to focus on an unresolved goal that was causing them to feel sad, down or stressed (as opposed to focussing on a resolved goal in the control group), thus using self-relevant goal discrepancy to induce a state of ruminative thinking. This task was chosen because its self-relevant nature lends itself to a more powerful, long lasting manipulation (e.g. Riemann & McNally, 1995; Brown & Taylor, 1986).

An unresolved goal may be as negative, problematic and upsetting for an individual without dysphoric symptoms as it is for someone who is already feeling low in mood. It may be expected that we would not find that the effects of rumination would be exacerbated in the dysphoric group. As such, future research should look specifically at depressive rumination, as opposed to rumination in response to goal discrepancy, in order to effectively test the application of RST in postnatal mothers. In sum, study 4 provides partial support for RST in that it demonstrates that an internal thinking style does impact behaviour, but it is an internal focus that is focussed on a goal discrepancy, rather than an internal focus that is simply focussed on the causes and consequences of sad mood. This is important because it suggests that this kind of an internal focus can be detrimental to parenting across both dysphoric and non-dysphoric mothers.
7.2.2 Implications of thesis findings for the Response Styles Theory and Goal Theory

7.2.2.1 The association between rumination, maternal attunement and depressive symptoms

Study 4 demonstrated that depressive symptoms did not moderate the effect of goal focused rumination on maternal behaviours. This finding provides some support for a goal focussed account of rumination, versus an RST account. The Goal Progress Theory (Martin, Tesser & McIntosh, 1993) conceptualises rumination as repetitive thinking about goal discrepancy. Here, rumination is defined not as a reaction to mood per se, but instead a response to failure to reach a goal. Large discrepancies and slower than desired progress towards the goal are proposed to result in both sad mood and repetitive thinking about the discrepancy and lack of appropriate progress. In contrast, RST proposes that whilst many people are likely to ruminate at one time or another, there are a subset of individuals who tend to more often respond to feelings of depression or distress with rumination and can therefore be described as having a ruminative response style. This account provides a rationale for hypothesizing that rumination may play a role in the exacerbation of depressive symptoms, including worsening dysphoric mood, increasing negative thinking and impairing key cognitive and behavioural mechanisms that are important for sensitive and responsive parenting.

Stein’s (2010) proposal of preoccupation primarily focuses on an RST account, but to date there is a lack of strong evidence supporting an RST account. Rather, the results of study 4 indicate that a particular kind of internal focus may lead to behavioural difficulties with the infant. However, Study 1 does demonstrate an association between depressive symptoms and maternal attunement that was mediated by brooding, but not reflective rumination. This finding is consistent with RST; brooding can be regarded as a passive comparison of one’s situation with some unachieved standards (e.g. “thinking about a
recent situation, wishing it had gone better”; Treynor et al. 2003, p. 256). In contrast to reflective rumination, brooding has been associated with more depression both concurrently and longitudinally (Treynor et al., 2003). However, it is important to consider that study 1 also showed the reverse relationship to be true; maternal attunement was found to be a plausible mediator of the relationship between maternal mood and brooding rumination. Thus, support for an RST account is inconclusive, as these results raise questions regarding the temporal relationship between attunement, mood and rumination.

7.2.2.2 Rumination as a causal cognitive mechanism explaining reduced maternal attunement in the context of postnatal depressive symptoms

Rumination and perceived maternal attunement

In accordance with RST, this thesis hypothesised that in the context of maternal depressive symptoms the effects of rumination would be exacerbated, leading to poorer maternal attunement in mothers who were both reporting depressive symptoms, and increased rumination. However, the findings of studies 2 and 3 presented a challenge to the application of RST in a postnatal context. Critically, both studies demonstrated a unidirectional relationship between rumination, attunement and maternal mood that is contrary to the hypotheses of RST. Specifically, poorer maternal attunement was identified as an antecedent of increased rumination, both prospectively and in a state (i.e., non-dispositional) context, rather than rumination predicting maternal attunement. These results suggest that a goal discrepancy (i.e., not feeling attuned with baby when this may be the desired goal), may be a predictor of rumination, rather than the other way around. In support of this notion, research into the reasons why people ruminate identifies solving problems and preventing future mistakes as well as increasing awareness and understanding.
as being the most frequently reported benefits (Watkins & Baracaia, 2001; Kingston, Watkins & O’Mahen, 2013).

In further support of the application of Goal Theory, study 3 identified that the effects of poorer bonding at time 1 on mood at time 2 were mediated by rumination on day 2. However, conclusions should be drawn with care; both studies 2 and 3 were conducted with a community sample of mothers who exhibited a narrow range of both depressive symptoms and ruminative response scores. As such it is important to consider that for mothers who are not reporting particularly high depression scores, any rumination reported is less likely to be in the context of dysphoria. It is speculated therefore that any mother, regardless of her mood, that is not feeling attuned to her infant may be likely to ruminate about it. Notably, these studies also did not assess goal focussed rumination. Rather, rumination was assessed as a response to sad mood using the Response Styles Questionnaire (Nolen-Hoeksema & Morrow, 1991; Treynor et al., 2003). As such it is not possible to conclude that the rumination reported was in response to impaired maternal attunement specifically. Therefore, to more fully understand the temporal relationship between rumination and attunement, it would be necessary to 1) assess goal focussed rumination and 2) replicate these studies with a clinical sample of mothers who meet criteria for postnatal depression, and exhibit a broader range of rumination scores. This would enable valid conclusions to be drawn regarding the implications of dysphoric rumination for maternal attunement, and vice versa. Regardless, these findings do highlight that difficulties with feeling attuned to your infant may be important in the postnatal period for non-clinical populations, with potential implications for both rumination and negative affect.
Rumination and maternal behaviours

It has been speculated that negative maternal cognitions, such as rumination, may be an important mechanism in the relationship between maternal depressive symptoms and poorer mother-infant interaction behaviours (e.g. Stein et al., 2012). Previous research has identified a causal relationship between maternal depressive symptoms and disengaged, unresponsive and withdrawn behaviours, including a lack of sensitive responding to the infant (Malphurs, Raag, Field, Pickens & Pelaez-Nogueras, 1996). Other research has shown that depressed mothers exhibit more rough and controlling behaviours (e.g. rough pulling and poking) when interacting with their infant (Fergus et al., 1996) compared to non-depressed mothers. This thesis demonstrated that rumination reduced sensitive maternal behaviours towards her infant, and the dyadic synchrony between a mother and her infant during an interactive play task. Given that this was demonstrated using a direct experimental manipulation of rumination, this finding provides strong support for the notion that rumination directly impacts maternal attunement with her infant.

7.2.2.3 Implications for the integration of Response Styles Theory and Goal Theory

This thesis took two theoretical approaches and has found some support for both the application of the Response Styles Theory and Goal theory explanations the relationship between rumination and maternal attunement in the postnatal period. Whilst studies 2 and 3 of this thesis suggest that perceived impaired attunement is an antecedent of rumination, it is argued that the impact of rumination is still important to consider in a postnatal context. This is not only because study 4 reveals that rumination does directly affect maternal behaviours, but also because if you are not feeling attuned with or bonded to your infant, this could maintain depressive symptoms via rumination. This assertion takes both a RST and Goal Theory approach, and is consistent with a large body of
literature which demonstrates that rumination is implicated in the maintenance of low mood (e.g. Kuehner & Weber, 1999; Nolan et al., 1998).

7.3 Strengths and limitations of the thesis research

This thesis presents an in-depth assessment of the relationship between maternal attunement, rumination and maternal mood that develops understanding and builds on the growing body of existing research in this area. An important strength of this thesis was the use of both a prospective design and a daily diary design with two separate samples, providing the opportunity to explore the antecedents of and responses to poor maternal attunement both prospectively, and in everyday contexts. The use of two separate samples also allowed for a comprehensive examination of the temporal relationships between attunement, rumination and maternal mood. In addition, to the author’s knowledge no previous study has investigated both rumination and attunement in mothers as states that vary within individuals and fluctuate in response to day to day situations and events. The strong experimental design employed in study 4 also provided evidence for a direct, causal relationship between rumination and maternal behaviours using a manipulation of ruminative thinking that was self-relevant and therefore more powerful and ecologically valid compared to existing rumination inductions. Study 4 also included an assessment of maternal behaviours that incorporated an examination of the impact of a stressor on mother-infant interaction in the context of rumination.

However, a number of limitations of this thesis should also be discussed. First, three of the four studies in this thesis relied on self-report measures of attunement, rumination, maternal mood, social support and infant temperament. Whilst using self-report assessment allows for practical and feasible access to participants’ views, opinions and perceptions about themselves and their environment, using this method of assessment is coupled with
the assumption that the participant is being truthful, and not exhibiting social desirability bias. This issue may be particularly pertinent given social perceptions of how a mother should feel about her infant. For example, the Postpartum Bonding Questionnaire asks intimate questions about the mother-infant relationship (e.g. “I resent my baby”, “I wish my baby would somehow go away” and “I regret having this baby”) that a mother may not feel comfortable answering honestly. This emphasises the importance of assessing attunement using alternative, more objective methods in future research. A second assumption of this approach is that self-report assessments of mothers who are feeling low or experiencing dysphoric symptoms are not being influenced by the negative affect, thus demonstrating negative reporting bias. To reduce such threats to the reliability of self-report measures, future research should endeavour to collect data from third parties, such as partners, health visitors or other family members.

Another important issue in this thesis that has arisen from using self-report measures is the inconsistent findings obtained with self-report compared to objective assessments of behaviour. Studies 2 and 3 demonstrate that poor maternal attunement predicts increased rumination; a relationship that was demonstrated to be unidirectional in both studies, using independent samples. In contrast, study 4 reveals that a direct manipulation of rumination reduces maternal sensitivity as assessed using objective assessment of interaction behaviours. It is speculated that there could be a number of reasons for the inconsistencies in these findings. First, they could be due to the limitations discussed in using self-report measures. Thus, given that study 4 employs an experimental design, it would be prudent to suggest that rumination impacts maternal attunement behaviours. However, whether perceived maternal attunement predicts self-reported rumination is arguably less conclusive. A second possibility lies in the samples recruited in studies 2 and 3. The community samples recruited from these studies exhibited a narrow
range of both depressive symptoms and ruminative response scores. It is possible that mothers experiencing dysphoric symptoms, or with a clinical diagnosis of postnatal depression may report a different relationship between dysphoric rumination and felt attunement. A final explanation for the inconsistent findings lies in the multifaceted definition of attunement that this thesis adopts. Attunement can be defined as comprising responsiveness, sensitivity, closeness and bonding, and encompassing maternal thoughts, feelings and behaviours (e.g. Markova & Legerstee, 2006; Meins, 1999; Mead, 2004). The studies in this thesis assessed a number of aspects of attunement and their relationship with rumination, finding different patterns of results even within study 1 which used two different self-report measures (e.g. study 1 found that rumination was associated with maternal responsiveness, but not bonding). Thus it is possible that rumination may have different relationships with different aspects of maternal attunement.

There is also an important distinction to be made between felt attunement and attunement behaviours. Because the Postpartum Bonding Questionnaire has been successfully validated against objective measures of maternal behaviour (Muzik, Bocknek & Broderick et al., 2013) there is some evidence to suggest that we might expect to find consistent results between study 2 (using the PBQ) and study 4 (using objective behavioural assessments of maternal attunement). The failure of this thesis to demonstrate consistency across behavioural and self-report measures provides some support for the notion that rumination could have differential relationships with felt compared to observed attunement, a hypothesis that deserves further attention in future research.

A second limitation of this thesis is that none of the samples were recruited based on clinical diagnosis, and it is recognised that the relationships between attunement, rumination and mood may differ in mothers diagnosed with postnatal depression. Moreover, selection bias may have influenced the results of the studies using community
samples in this thesis. Given the time commitment and energy required to volunteer and participate in academic research, particularly whilst caring for a small infant, it is possible that these mothers were particularly motivated, and higher in mood, than a sample selected based on clinical diagnosis. This may be a particularly pertinent point for study 3, which required daily contributions to the study over a 2 week period. Given the potential clinical applications of understanding the temporal and causal relationships between attunement, ruminative thinking and maternal mood, it will be important for future research to examine these relationships with a clinically depressed sample of mothers in the postnatal period. It is noteworthy that study 4 does utilise a sample of dysphoric mothers (scoring above 14 on the BDI II). Many studies of rumination have used dysphoric samples and community samples and have found results similar to those with clinical samples (e.g. Lyobomirsky & Nolen-Hoeksema, 1995; Nolen-Hoeksema & Morrow, 1991). However, future research should endeavour to replicate these results with mothers who meet the diagnostic criteria for depression.

A third limitation of this thesis is that the content of ruminative thinking was not assessed in studies 1 to 3. Therefore, it is not possible to establish whether participants were ruminating specifically in response to perceived impairments in attunement with their infant, supporting the application of Goal Theory in this context. It is also noteworthy that dysphoric rumination (operationalised using the Response Styles Questionnaire) as opposed to goal focussed rumination was assessed in studies 1 and 2. Thus, participants were reporting rumination as a response to sad mood, rather than failure to progress towards a goal. Given that we assessed dysphoric rumination, we might expect that maternal mood would moderate the relationship between poor attunement and increased rumination, with the effect of attunement on dysphoric rumination being significant when mood was low. Instead, study 2 demonstrated that mothers reporting poorer bonding at time one, but not
low mood at time 1 subsequently experience more dysphoric rumination at time 2. It is not clear from these findings whether the dysphoric rumination is reported as a response to low mood that is being experienced in parallel at time 2, both as a result of the impaired bonding. Such questions highlight the importance of assessing goal rumination in future research.

7.4 Clinical implications

7.4.1 Implications for clinical intervention and parenting programmes

The results of this thesis suggest that rumination can have a detrimental impact on maternal behaviours (study 4), and that poor maternal attunement predicts low maternal mood via increased rumination (study 3). As such, it is suggested that difficulties experienced by mothers in the postnatal period could be addressed through targeted interventions that either focus on the problems experienced with the infant, or the rumination. Given the finding of this thesis that poor maternal attunement predicts lower maternal mood, we might expect that interventions focussing on improving the mother-infant relationship would also potentially improve depressive symptoms. However, findings from existing intervention studies are mixed; for example, Toddler-Parent Psychotherapy (TPP; Cicchetti, Toth, and Rogosch et al., 2000) improves maternal sensitivity and responsivity, but does not reduce depressive symptoms, whilst the Mothers and Toddlers Programme (MTP; Suchman, DeCoste & Castiglioni et al., 2011) demonstrated improvements in both maternal behaviours and depressive symptoms post intervention. Thus it appears that in some circumstances, addressing difficulties in the mother-infant relationship does alleviate depressive symptoms. This, coupled with the findings of this thesis, suggests that discrepancies in parenting related goals could either be a risk factor for depression, or involved in the maintenance of depressed mood via rumination in the
postnatal period. It may therefore be useful to address such discrepancies more consistently in existing and future interventions for postnatal depression. However, this assumes that problems in the mother-infant relationship are the key driver of depression. It is conceivable however, that problems in the mother-infant relationship are one of a number of possible drivers of depressed mood. This notion is supported by the reported inconsistencies in the effectiveness of parenting interventions for reducing maternal depressive symptoms, which suggests that impairment in the mother-infant relationship is not a key difficulty for all mothers in the onset and maintenance of depression. Future research should assess maternal goals and problems in interventions that address the mother-infant relationship, in order to examine whether these are potential moderators.

Whilst there are many interventions that focus on treating postnatal depressive symptoms, there is some evidence to suggest that these interventions do not substantially improve the mother-infant relationship, or the longer term child outcomes. For example, a trial comparing the short and long term effects of three psychological treatments (counselling, CBT informed mother-infant therapy and psychodynamic therapy) for postnatal depression on the quality of the mother-infant relationship and child socio-emotional development only found limited benefits on mother-infant outcomes (Murray, Cooper & Wilson et al, 2003). Whilst all three treatments improved perceptions of difficulties in the mother-infant relationship, none of them had a significant impact on management of early infant behaviour difficulties, mother-infant attachment security, infant cognitive development or child outcomes at 5 years. So whilst these studies indicate the treatment is effective in treating maternal depression, there is limited impact on the mother-infant relationship. Murray and colleagues also noted that the strongest effects of each of the treatments were found for measures that relied on self-report. The findings of this thesis suggest that rumination focussed interventions may be beneficial in improving the quality
of mother-infant interactions, and potentially the overall quality of the relationship. To the author’s knowledge, such an intervention has not yet been developed specifically for use in the postnatal period, with the intention being to improve the mother-infant relationship. However, because this thesis has demonstrated that goal focussed rumination, as opposed to depressive rumination, is implicated in reduced maternal sensitivity, the efficacy of an intervention that targets the effects of depressive rumination is not yet clear.

A rumination focussed intervention for postnatal mothers may include work on disengaging from rumination to address the avoidance aspect of ruminative thinking, using effective problem solving, and becoming more effectively engaged in appropriate action ‘in the moment’ (including being absorbed in the moment). The results of this thesis suggest rumination may a key mediator of the effect of attunement on maternal mood. The added benefit of such an intervention could be that by targeting rumination as a key mediator of this relationship, it may address a process that is leading to poor mood, but also one that leads to poor maternal behaviours (study 4). Because this thesis suggests that rumination is not necessarily mood dependent, but can lead to poorer mood, a rumination targeted intervention could be a more universal type of intervention for parents. This may be particularly relevant for those who may be at higher risk of ruminating (indicated prevention). A rumination intervention would address rumination around parenting, but also other goal discrepancies. As such, a consideration of approaches to dealing with goal discrepancies in the postnatal period will follow in the next section.

7.4.2 Resolution of goal discrepancies

One method that can be employed to reduce the impact of goal discrepancies is to challenge the strategies used to manage emotions. The literature distinguishes between 1) antecedent-focused emotion regulation; things an individual does before emotion response
tendencies have become fully activated and have changed behaviour (e.g. reappraisal) and 2) response-focused emotion regulation; the management of existing emotions, such as rumination or suppression (Gross, 1998). Research has demonstrated antecedent focused strategies to be more efficacious than response focused strategies which in comparison are associated with greater levels of physiological responding and negative affect as well as poorer wellbeing and interpersonal functioning (Gross, 1998; Gross & Levenson, 1993, 1997; Gross & John, 2003). This is consistent with more recent research which highlights the role of response focused strategies such as rumination, suppression and avoidance in both the onset and maintenance of depression and anxiety (e.g. Aldao, Nolen-Hoeksema & Schweizer, 2010; Mennin et al., 2007; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Thus, for mothers who are experiencing discrepancies in their parenting goals, therapies or parenting programmes that focus on teaching reappraisal skills may be effective in reducing the probability that discrepancies will be managed with a ruminative response style.

A second approach to dealing with failure to achieve or make appropriate progress towards a parenting goal may be to address the behaviours that directly result in the discrepancy. For example, a mother who is not feeling bonded with her infant may require parent education, additional support in caring for her infant, help to develop her parenting and problem solving skills or support in developing a greater sense of efficacy and self-esteem. Systematic reviews indicate that parenting programmes can have a positive impact on child behaviour, maternal self-esteem and mother–child interaction and can lead to decreases in maternal depression and stress (Bunting, 2004). However, there is some evidence to suggest that whilst parenting programmes effectively develop and improve observable parenting skills, they do not impact ratings of effectiveness as a parent, or enjoyment as a parent (Long, McCarney & Smyth et al., 2001). Given that the findings of
this thesis highlight the impact of felt attunement with infant on rumination, a programme that places an emphasis on improving the perceived relationship between mother and infant as well as developing parenting skills and behaviours may be particularly effective for mothers that are struggling to feel bonded with their infant.

A caveat to this point however, is that we are assuming that being a good parent, or feeling well bonded with your infant, and other such higher level parenting goals are important for all mothers. It is important to consider that this may not be the case, and an assessment of this, as well as the extent to which parenting goals are intrinsic versus introjected, will be important in future research in order to establish the impact of such individual differences on the effectiveness of any intervention or parenting programme.

7.5 Future research directions

The findings of this thesis, and the limitations discussed highlight some key directions for future research. The following section will discuss some suggestions to further examine the relationship between rumination, attunement and maternal mood. First, the results of this thesis suggest that ambiguous infant behaviours and making causal attributions about reasons for feeling low in mood may be specific contextual factors which impact the relationship between maternal mood, rumination and attunement. Because rumination was associated with attunement only when infant negative affect was reported to be low (study 1), it suggests that rumination is occurring more in the context of having an infant that exhibits fewer difficult or negative behaviours. Previous research has already demonstrated that people ruminate because they believe that it aids insight and understanding into situations (Kingston, Watkins and O’Mahen, 2013) and Brewin (1999) argues that attributional activity is provoked by novel and unfamiliar stimuli that demand interpretation. Thus, it may be that rumination is more likely to be provoked in parenting
situations that are potentially causally ambiguous and where the causes of low mood are therefore unclear. A first step to extend the findings of this thesis and research into the reasons why people ruminate would be to test for a positive association between reports of ambiguous infant temperament and rumination scores, and to examine whether ambiguous infant behaviour moderates the relationship between maternal mood, ruminating and attunement. It will also be important to directly examine participants’ perceived reasons for feeling unhappy to establish whether causal attributions for low mood are specifically in the context of being a parent and unclear infant behaviour (e.g., “why am I unhappy in parenting? My baby is not difficult and seems fine.”).

A second, novel method by which to investigate the role of ambiguity in the causal relationship between rumination and attunement would be to utilise a similar experimental paradigm to that used in study 4. By coding the tapes for ambiguous or neutral infant behaviour it would be possible to test the hypothesis that ambiguous infant behaviours moderate the effect of rumination on maternal attunement behaviours. This was not possible to examine in study 4 of the current thesis due to the coding procedure (CARE Index; Crittenden, 2005) used, which does not permit the coding of neutral infant behaviour (only cooperative, difficult, compulsive and passive). Thus, a coding system that scores infant behaviour on a continuous scale of positive to negative may be more appropriate, such as the behaviour-state system developed by Cohn et al. (1986) for coding depressed mother-infant interactions. Such a system would acknowledge the presence of more ambiguous behaviour by selecting the middle score, which would be required to test this hypothesis. A final interesting extension of this design would be to examine post-event rumination as a response to infant behaviour that has been coded as more ambiguous. Kashdan & Roberts (2007) asked participants to remember a social interaction that took place on the previous day and report on their thoughts since the interaction. Participants
were asked to indicate how much they thought about the interaction, how negative their thoughts were, how much they criticized themselves for handling the interaction, how much they thought about their anxiety during the interaction, and how much they thought about other past conversations and interactions. By using a parent specific adaptation of this task it will be possible to directly assess whether ambiguous infant behaviour increases ruminative thinking in mothers.

The results of this thesis demonstrate that goal focussed rumination has direct adverse consequences for maternal behaviours when interacting with her infant. However, what is not clear is whether rumination as a response to depressed mood also has the same impact. Previous findings indicate that numerous aspects of maternal sensitive behaviour are disrupted in the context of PND (e.g. Malphurs et al., 1996; Fergus et al., 1996; Herrera et al., 2004) and this thesis has argued that rumination as a response to depressed mood is a plausible mechanism explaining this relationship. Study 4 demonstrates that mothers higher in trait rumination are less sensitive in their interactions with their infants, which provides some support for this hypothesis (Chapter 6, Appendix D). However, a direct manipulation of depressive rumination will be necessary to infer causality. One other experimental study to date has explored the causal role of rumination in impairments in mother-infant interaction behaviours (Stein et al., 2012), finding a non-significant trend of reduced responsiveness to infant vocalization in mothers with depression. However, the rumination induction in this study could arguably be improved upon in length and specificity, given that it was more strongly related to worry, rather than rumination. Traditional methods of inducing depressive rumination, such as Morrow and Nolen-Hoeksema’s (1991) response manipulation task require the participant to focus their attention and “think about” a series of 45 items that are emotion focussed, symptom focused and self-focussed. However, such tasks are passive and not self-relevant and
therefore demonstrate less ecological validity. There is evidence to suggest that self-referential material may be more powerful when inducing cognitive states (e.g. Riemann & McNally, 1995; Brown & Taylor, 1986). It is also speculated that a task that requires the participant to simply sit and think may not be suitable for a mother with a young infant. Parents of young infants are often subject to feelings of fatigue and tiredness. Tiredness affects concentration levels, therefore, a situation in which the infant is taken out of the room and the mother is left alone to complete the task may be more relaxing than rumination inducing, and the mother may not immerse herself fully in the task. Moreover, the results of this thesis demonstrated that an induction that requires the participant to think about personal goals was successful in increasing a state of analytical and evaluative thinking. Thus, future research should consider adapting this induction to also focus on the maladaptive consequences of rumination as a response to negative mood. In this way it will be possible to test the hypothesis that rumination in the context of depressive symptoms is more detrimental to maternal sensitive behaviours compared to non-depressive rumination, and individuals in a control condition.

A novel finding of this thesis is that attunement with infant (operationalised via an indication of felt closeness) is not necessarily stable across time. Rather, study 3 highlights that it is not always consistent within individuals, and is therefore fluctuating and context dependent. Consistent with previous research (e.g. Moberly and Watkins, 2008) rumination was also found to be dynamic, exhibiting variability from day to day. An interesting extension of these findings would be to examine the state relationships between ruminative thinking and attunement moment by moment, in response to both emotional and practical parenting experiences as they happen throughout the day. Based on the findings of this thesis, we might predict that difficult parenting situations, or less felt closeness with infant may immediately precede increases in rumination, and decreases in mood throughout the
One method that could be employed to examine this hypothesis is Ecological Momentary Assessment (EMA; Stone & Shiffman, 1994). EMA asks the participant to report on subjective (as well as objective) states as they occur at various times over the day. Crucially, this method addresses a number of limitations of traditional daily diary methods, which often rely on retrospective reports of the day.

Whilst this thesis took an important first step in examining the state relationships between ruminative thinking, attunement and maternal mood using a more ecologically valid method, such retrospective reports can be vulnerable to recall bias (Stone et al., 1998) and cannot inform on the time course of a ruminative episode or its temporal relationship to fluctuations in mood and feelings of closeness with infant as they happen momentarily. However, the practicality and feasibility of undertaking such a study with mothers of young infants is problematic. One way to address some of the difficulties associated with applying this methodology may be to use mobile phone applications to collect data. Kuntsche & Labhart (2013) note that most people own a mobile phone, are familiar with the different functions, and always carry it with them, making it a more feasible method by which to collect such data compared to watches or pagers that may be forgotten when out of the house, or ignored.

Finally, this thesis posited that rumination may cause deficits in maternal attunement via the disruption of cognitive and behavioural mechanisms that may be important parenting mechanisms, such as attention (Pearson et al., 2009; Donaldson, Lam and Matthews, 2007). Whilst the attentional bias paradigm employed in study 4 (Chapter 6, Appendix C) did not demonstrate any significant effects of rumination or dysphoria on disengagement with infant distressed stimuli, a non-significant trend in means suggests that mothers in the dysphoric/rumination group did demonstrate a bias away from infant distress, compared to the slower disengagement observed in the other three groups. It is
possible that the negative findings in this study reflect a small sample size and a fully powered study may detect significant effects. Furthermore, the attentional bias task was completed following the study procedures described in the main body of Chapter 6. Following a 10 minute break after the end of the CARE Index task, participants were required to repeat the rumination induction task, followed by the attentional bias task. It is possible that the effects of the rumination task were not as powerful after completing it a second time. Thus it is suggested that a fully powered replication of this study design, where attentional bias is the only outcome measure of the study would be worthwhile.

7.6 Conclusions

In conclusion, this thesis has presented and tested a theoretical model of the relationship between maternal mood, rumination, maternal attunement and contextual factors. The findings support the hypothesis that goal focussed rumination causes impairments in maternal attunement behaviours, but did not find that rumination in the context of dysphoric symptoms impacts behaviours (study 4). However, this was perhaps to be expected given the goal focussed nature of the rumination induction employed in this study, and deserves further attention in future research. This thesis also failed to demonstrate the same pattern of findings with perceived maternal attunement. Instead, the findings of analyses with two different community samples suggest that perceived impairments in bonding are predictive of increases in ruminative thinking, both at 6 months, and over the course of 10 days. These findings have important implications for the application of theoretical models of rumination in a postnatal context.

Specifically, study 4 demonstrates some support for the notion of ‘preoccupation’ (Stein et al., 2009) which, consistent with the Response Styles Theory of rumination, suggests that rumination reduces attention and responsivity to the environment via a state of
narrowed attention, which impacts a mother's ability to respond appropriately to her infant's cues and needs. However, the findings of this thesis also warrant further testing of the application of Goal Theory, and the hypothesis that reports of poor attunement may reflect felt discrepancies in higher level parenting goals to which the mother responds with increased rumination (Studies 2 and 3) and lower mood (study 3). These findings suggest that further investigation into the directional and temporal relationships between rumination and attunement is needed, whilst also evaluating goal focussed rumination and the content of maternal rumination in both clinical and community samples.

Together, these findings build on emerging evidence of the relationship between maternal mood, rumination and maternal attunement. They highlight a temporal relationship between rumination and different aspects of felt maternal attunement and a causal relationship between rumination and attunement behaviours. This body of results emphasises the importance of considering rumination in a postnatal context not just because it can directly impact maternal behaviours, but because if a mother is not bonding well or feeling close to her infant, this could potentially result in the onset or maintenance of depressive symptoms, via increased rumination. As such, the thesis findings provide an early indication of the efficacy of both screening for and targeting rumination in a clinical postnatal context via therapeutic treatments and parenting programmes. The findings of this thesis further indicate that this may be a worthwhile endeavour for all mothers, as opposed to just those considered to be at risk.
References


Appendix 1: The effects of an experimentally induced low mood in high compared to low trait ruminators: a pilot study

Preface

In studies 2 and 3 of this thesis the prospective relationships between rumination, maternal attunement and depressive symptoms were empirically tested. Broadly consistent with theoretical models which indicate that rumination occurs as a response to failure to reach a goal, or make satisfactory progression towards a goal (i.e. goal discrepancy; Tesser, Martin and McIntosh, 1993), the results of study two demonstrated that perceived impairments in bonding with infant predict greater levels of trait rumination and lower mood over a six month period. Study three also replicated this finding in a non-dispositional context, highlighting the importance of contextual factors and everyday situations in the fluctuation of ruminative thinking and feelings of closeness with infant day by day. Contrary to predictions, rumination did not predict lower levels of perceived bonding in either of these studies.

Notably, study 3 also found a relationship between trait and state rumination. Consistent with the findings of other recent studies (e.g. Roberts et al., 2013; Moberly and Watkins, 2008), trait levels of rumination were found to be associated with state levels of rumination. An interesting extension of previous findings however, was that trait rumination was also found to moderate the relationship between state bonding and state rumination. Specifically, state bonding was associated with state rumination when levels of trait rumination were low, but not high. Whilst we cannot offer a clear explanation as to the unexpected direction of this relationship, it is speculated that when a mother doesn’t use rumination as a strategy to deal with problems and emotions in a trait like way, perceived
daily difficulties in bonding with infant may trigger momentary states of rumination that are fluctuating and contextual, perhaps in an attempt to problem solve or increase understanding of the situation (Kingston, Watkins & O’Mahen, 2013). Conversely, when rumination is a characteristic, stable emotion regulation strategy that is used by the mother, this is associated with state rumination over and above perceptions of closeness with the infant. Thus, at a daily level, it is possible that being a high trait ruminator is a better predictor of state rumination than daily perceptions of closeness with infant. Over a longer period of time however, the results of study 2 suggest that poorer perceptions of bonding with infant are more predictive of later rumination than baseline levels of rumination.

Whilst the evidence presented in study 3 of this thesis suggests that the daily effects of trait rumination on state rumination may not have particularly negative consequences for how a mother feels about her relationship with her infant (rather, poorer perceived bonding increases rumination), the results of study 4 suggest that rumination can impair a mother’s behaviours towards her infant. Study 4 has demonstrated that experimentally inducing ruminative self-focus significantly decreases sensitive behaviours (as opposed to perceptions and feelings that were measured in studies 2 and 3) as assessed via direct observations of mother-infant interactions, providing some support for RST and the notion that ruminative thinking can have a detrimental impact on the mother-infant relationship. Study 4 also demonstrated that mothers who reported higher trait rumination behaved significantly less sensitively towards their infants overall, compared to low trait ruminators. It is therefore suggested that both rumination as a stable and trait like characteristic, and induced states of ruminative thinking may impair a mothers sensitive behaviours towards her infant.
However, this thesis has not directly examined how trait rumination may be impacting maternal behaviours. A first step towards answering this question can be made through an examination of the relationship between trait and state rumination, and the possible mechanisms driving this relationship. Stein et al. (2010) posit that a state of narrowed or self-focused attention (e.g. rumination) may impair a mother’s ability to respond sensitively towards her infant. Trait rumination is predictive of state rumination (Roberts et al., 2013); therefore it is proposed that trait rumination may impact maternal behaviour by increasing the severity and duration of state rumination and negative affect (i.e. a mother who has a greater tendency to ruminate in response to her problems or emotions will also experience more self-focused attention ‘in the moment’ as a response to a situation that provokes low mood). This appendix presents the findings of a preliminary investigation into the mechanisms that drive the effects of trait rumination on a self-focused state of attention. An understanding of these mechanisms and the subsequent effects of the trait/state rumination relationship on both the temporal pattern and severity of emotional response is important in order to better understand the conditions that foster less sensitive maternal behaviour.

Many studies have examined the impact of experimentally induced rumination on naturally occurring depressed mood. However, to the author’s knowledge no studies have investigated the effects of an experimentally induced low mood on state ruminative self-focus and state mood in high trait ruminators compared to low trait ruminators. Because evidence suggests that rumination is a vulnerability factor for low mood (Moberly & Watkins, 2008) it was hypothesised in the following pilot study, that an induced low mood state may be one mechanism driving the relationship between trait and state rumination.
Specifically, this pilot study hypothesised that 1) high trait ruminators will experience a more severe drop in mood following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. Further, because experimental studies have demonstrated that experimentally induced rumination plays a causal role in the exacerbation of negative affect, increases negative thinking and increases negative cognitions (Lyubomirsky, Tucker, Caldwell, & Berg, 1999; Nolen-Hoeksema & Morrow, 1993), it was also hypothesised that 2) high trait ruminators will take longer than low trait ruminators to return to baseline levels of mood following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction and 3) that high trait ruminators will report more self-focus following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. Finally, because trait rumination is predictive of state rumination, it was expected that 4) high trait ruminators will be self-focused for a longer period of time following a low mood induction, compared to low trait ruminators and participants in a neutral mood induction.

Methods and results

Appendix 1 presents an initial investigation of the study hypotheses. As such, this study used an opportunity sample of Undergraduate students from the University of Exeter recruited via email adverts and flyers. An a priori power analysis was conducted prior to data collection (using G* power application) to estimate the number of participants required to minimize the risk of type II error (section 7.8, Appendix A). State mood and ruminative self-focus were operationalized using single Likert type scales that were presented pseudo-randomly a total of 120 times across four continuous blocks during a 55 minute modified Sustained Attention to Response Task (SART) that places minimal demands on controlled
processes to provide an assessment of attentional lapse and self-focus. The modified SART provides a context that increases the likelihood of mind wandering by demanding a repetitive and automatic style of response to the stimuli presented (Roberts et al., 2013). The mood and self-focus questions therefore identified ‘in the moment’ changes in emotional response to a prior low or neutral mood induction throughout the task.

Preliminary data analyses were conducted in PASW statistics, version 18. Data were initially checked for accuracy, missing data, outliers and normality through an examination of descriptive statistics and graphic representations of all key variables. An important assumption of ANOVA is that the response variable residuals are normally distributed. Nonnormality was evident in aggregated scores for state mood in each block of the modified SART. To address this issue, log transformations were used to normalise this variable (Appendix 1.2)
Abstract

Whilst many studies have examined the consequences of an induced ruminative state on naturally occurring depressed mood, studies have not yet examined the impact of an experimentally induced negative mood state on trait rumination as a mechanism that drives the observed effects of trait rumination on state rumination and state mood. This study investigated the hypothesis that high trait ruminators will experience a more severe drop in mood, and a greater level of self-focus that would persist for a longer duration following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. Sixty-eight undergraduate students completed baseline measures of mood and the Response Styles Questionnaire (RRS) before being randomised to either a low mood induction or a neutral mood induction. Participants then completed an online measure of state rumination and state mood. The mood induction procedure was not successful. Thus, contrary to our hypotheses, high trait ruminators did not differ significantly in their reports of current mood or feelings of depression following a low mood induction compared to low trait ruminators, or participants following a neutral mood induction. Further, high trait ruminators did not take longer to return to baseline levels of current mood following a mood induction. Levels of self-focus immediately following the low mood induction were not higher in high compared to low trait ruminators. However, individual differences in trait rumination were found to be associated with differential levels of self-focus during the online task, supporting the hypothesis that individual differences in trait rumination are associated with different temporal processes in state rumination, and differential levels of state rumination.
Introduction

Rumination, the behaviours and thoughts that focus an individual’s attention on their depressive symptoms and on the implications of these symptoms (Nolen-Hoeksema, 1991) is a widely studied and crucial component in the exploration of cognitive vulnerabilities to depression (Smith and Alloy, 2009). It is seen as a critical construct in understanding the development and persistence of depressed mood. However, although studies consistently demonstrate that rumination can occur as a response to depressed mood, it is also a stable, trait like characteristic that can be present independently of depression (Roberts, Gilboa, & Gotlib, 1998). It is therefore important to investigate mechanisms through which trait rumination leads to detrimental emotional responses. Whilst many studies have explored the effects of induced rumination on depressed mood, less is known about the effects of an induced state of negative mood on individuals who have a greater tendency to ruminate on a day to day basis, and how this may impact moment by moment emotional responses. This study will examine whether a low mood induction in high trait ruminators impacts severity and duration of negative affect, and self-focussed attention.

Rumination and depressed mood

There is considerable correlational and experimental evidence linking rumination and depressed mood. Studies of naturally-occurring dysphoria have shown that people who routinely ruminate in response to their negative moods report longer and more severe periods of dysphoria than those who manage their mood with pleasant, distracting activities (Nolen-Hoeksema, Larson & Grayson, 1999; Nolen-Hoeksema & Morrow, 1991; Roberts, Gilboa, & Gotlib, 1998). For example, Morrow and Nolen-Hoeksema (1991) found that the greatest remediation of naturally occurring depressed mood was observed in participants in
a distracting-active response condition, compared to distracting-passive, ruminative-active, and ruminative-passive response conditions. Overall, a more ruminative response style led to lesser remediation of depressed mood, and a more intense depressed mood.

Experimental studies have often involved assigning participants to either rumination or distraction conditions. These studies demonstrate that dysphoric participants, when induced to ruminate, experience greater increases in depressed mood than dysphoric participants induced to distract and non-dysphoric controls in either condition (Lyubomirsky, Caldwell & Nolen-Hoeksema, 1998; Lyubomirsky, Kasri, & Zehm, 2003; Trask & Sigmon, 1999). However, whilst there is a substantial body of evidence linking rumination to the maintenance, and to a lesser extent, the onset of depressed mood, it is also a trait that can be present independently of depression. In support of this notion, Roberts, Gilboa & Gotlib (1998) found that students with a past history of dysphoric mood reported more rumination than students with no history of dysphoria. Conversely, recent research has also drawn attention to the importance of understanding rumination as a dynamic process that can change and fluctuate over time in response to different emotional experiences and everyday events. Studies examining the test-retest correlations for the Response Styles Questionnaire (RRS) have produced inconsistent results (Just & Alloy, 1997; Kasch, Klein, & Lara, 2001), suggesting that rumination can change over time, and other recent research using Ecological Momentary Assessment (EMA) has demonstrated that engagement in ruminative thinking does in fact vary from moment to moment over the course of a day, and that rumination as a momentary behaviour exhibits a reciprocal relationship with negative affect (Moberly & Watkins, 2008). Thus, rumination can be characterised as both a trait like characteristic and a state like behaviour that is influenced by context, fluctuating with negative affect over time.
Trait rumination is also concurrently associated with state rumination while controlling for depressive symptoms (Moberly & Watkins, 2008; Tester-Jones et al., unpublished manuscript), and other research also indicates that trait rumination increases state rumination in response to unresolved goals (Roberts et al., 2013). Moreover, Roberts and colleagues found that individual differences in trait rumination moderated the impact of goal discrepancy on state rumination, suggesting that when rumination in everyday contexts occurs as a result of goal discrepancy, it is more severe when the individual has a greater tendency towards a ruminative response style as a trait characteristic.

Whilst these studies demonstrate a) that higher trait rumination can result in greater depressed mood and b) that trait rumination is predictive of state rumination, they do not investigate the mechanisms that drive these effects, nor the consequences for state rumination or state negative affect. Specifically, whilst it appears that rumination ‘in the moment’ is influenced by a greater overall tendency towards a ruminative thinking style, it is less clear whether it is the introduction of a lower mood state that exacerbates the effect of trait rumination on state rumination and state mood. Thus, an investigation of the relationship between trait rumination and moment by moment emotional responses to negative mood is required in order to understand what drives the effects observed between state mood and rumination.

**The present study**

Many existing empirical studies have focussed on understanding the consequences of a ruminative response style, with few examining rumination as a trait that is independent of depression, and its consequences for state emotional responses. Whilst a small body of literature has demonstrated that trait rumination is an important mechanism that increases
state rumination, these studies have not looked at the mechanisms that drive this relationship, nor the temporal or emotional consequences of state rumination in the context of immediate negative affect. To date, methodologies have used experimental inductions to replicate a ruminative thinking style to examine the consequences of state rumination. Moreover, the examination of trait rumination has only been conducted in the context of naturally occurring depressed mood. Thus it has not been possible to examine the direct and ‘in the moment’ impact of negative affect on both state rumination and mood as it occurs in individuals with a greater tendency to ruminate. By investigating this relationship it is also possible to examine rumination that occurs naturally as a response to negative affect, both temporally and involuntarily, thus replicating the often spontaneous and reflexive experiences of rumination in everyday life (Roberts et al., 2013).

Because ruminative thinking fluctuates over time, it is also critical to examine the occurrence of state rumination as it happens (Moberly & Watkins, 2008). In order to effectively assess the temporal pattern of state rumination and state mood, we adapted a measure of state rumination used by Roberts et al. (2013) that was sensitive to spontaneous ruminative thoughts over time. The sustained attention to response task (SART; Robertson, Manly, Andrade, Baddeley, & Yiend, 1997) uses a go/no-go paradigm that places minimal demands on controlled processes, thus providing an assessment of attentional lapse and self-focus as opposed to focus on the task. The SART provides a context that increases the likelihood of mind wandering by demanding a repetitive and automatic style of response to the stimuli presented. Pseudo-random thought probes then ask the participant to identify where their attention has been focussed since the last probe. To specifically assess state rumination in the task, the thought probes were adapted to assess the current level of self-focus. Participants were also asked to indicate their current mood during each probe, in order to measure the severity and duration of mood in high trait ruminators in the context of
immediately occurring negative affect. Experimental, experience sampling and diary studies have demonstrated that trait rumination is predictive of state rumination (Roberts et al., 2013; Moberly & Watkins, 2008; Puterman, De Longis & Pomaki, 2010) but to the authors knowledge, the interaction between trait rumination and experimentally induced ‘in the moment’ negative affect and its impact on the temporal processes of state mood and state ruminative behaviour have not yet been investigated. This is important because a better understanding of the impact of trait rumination on the course and duration of momentary state mood and ruminative thinking may inform on the mechanisms that drive the observed effects of rumination on behaviour in the wider literature.

Thus, the aim of the current study is to explore the interaction between trait rumination and induced negative affect, in order to examine a state of negative affect as a mechanism driving the effect of trait rumination on state ruminative behaviour, and state mood. Previous studies have not investigated whether a sad mood induction (1) creates a more intense sad mood in individuals high in trait rumination compared to those low in trait rumination, (2) if the sad mood is prolonged in those high in trait rumination or (3) if state rumination is prolonged in those reporting higher trait rumination compared to low trait rumination. Because individual differences in trait rumination are predictive of naturally occurring depressed mood (Nolen-Hoeksema, Larson & Grayson, 1999; Nolen-Hoeksema & Morrow, 1991), and evidence suggests that rumination is a vulnerability factor for low mood (Moberly & Watkins, 2008) it was hypothesised that 1) high trait ruminators will experience a more severe drop in mood following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. Further, because experimental studies have consistently shown that experimentally induced rumination plays a causal role in the exacerbation of negative affect, increases negative thinking and increases negative cognitions (Lyubomirsky, Tucker, Caldwell, & Berg, 1999; Nolen-
Hoeksema & Morrow, 1993), it was also hypothesised that 2) high trait ruminators will take longer than low trait ruminators to return to baseline levels of mood following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction and 3) that high trait ruminators will report more self-focus following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. Finally, because trait rumination is predictive of state rumination, it was expected that 4) high trait ruminators will be self-focussed for a longer period of time following a low mood induction, compared to low trait ruminators and participants in a neutral mood induction.

**Methods**

**Participants**

Sixty-eight undergraduate students at the university of Exeter and the local area (mean age = 19.77, \( SD = 4.96 \)), were recruited using emails and flyers advertising the study. The advert provided details on the study and requested volunteers who were and were not prone to worry. We recruited participants with a range of scores on the RRS in order to investigate the effect of high versus low trait rumination in response to a mood induction. All respondents were invited to participants regardless of their RRS score. This resulted in a final sample with a range of RRS scores (\( M = 41.70, SD = 11.32, range = 46 \)). Participants received their choice of course credits, or confectionary as a token of appreciation for their participation. All participants gave informed signed consent.

**Measures and materials**

*Dysphoric symptoms* were assessed using the Beck Depression Inventory-II (BDI II). The BDI–II assesses levels of depressive symptomatology with 21 items that are rated
on a scale from 0 to 3, with higher scores reflecting more depressive symptoms. Reported sensitivity (ranging from 43% to 82%), specificity (89%) and positive predictive value (50%) of the BDI-II in perinatal populations is good (e.g. Gaynes et al., 2005; Lee et al., 2001). Cronbach’s alpha in our sample was .94

Trait rumination was assessed with the Response Styles Questionnaire (RRS Revised). This version combines the original 22 item version (Nolen Hoeksema & Morrow, 1993) with the recent version reported by Treynor et al. (2003). Items common and unique to both versions were included (25 in total on a 4-point likert) such that the full range of ruminative responses (for example, reflection versus brooding; Treynor et al., 2003) could be calculated. The RRS scale demonstrated excellent internal consistency in this study (α = .96).

Mood inductions

Low mood induction To induce low mood a musical induction was used (Clark, 1983). Participants listened to seven minutes of “Russia under the Mongolian Yoke” from “Alexander Nevsky” by Prokofiev, recorded at half speed. Participants listened through headphones, and were asked to keep their eyes closed and concentrate on the music throughout the task.

Neutral mood induction For the neutral mood induction participants were instructed to listen to seven minutes of the electronic “Home computer” by Kraftwerk (Tang, Salkovskis, Hodges, Wright, Hanna, & Hester, J., 2008). A small section of this music was played on a loop so as to ensure no vocals were heard. Again, participants listened through headphones.
Sustained Attention to Response Task (SART) Participants were asked to complete a modified Sustained Attention to Response Task (SART; McVay & Kane, 2009). One thousand eight hundred words were individually presented on a computer screen for 300ms each, followed by 900 ms mask. Participants were instructed to respond to each word with a space bar button press. On a minority of trials (200; 11%) when the word was presented in uppercase participants were instructed to withhold their response. Four continuous blocks, each presenting 45 words, were repeated five times in a different order. Within each set of 45, five targets (no-go trials) appeared randomly amongst 40 non-targets (go trials). The task lasted approximately 55 minutes. Whilst completing the task, participants were interrupted pseudo-randomly (after 60% of the no go trials within each block) with two questions assessing their current mood, and current level of self-focus on the screen to which they were asked to respond. These questions identified ‘in the moment’ changes in emotional response to the mood induction throughout the task. The questions asked participants to select from several response options, which were explained before the task, to describe how they felt and what they were thinking about just before the questions were asked.

Current mood During the SART task participants were asked to indicate their current mood (please identify your current mood) on a single Likert type scale of 0 to 9 (where 0 = lowest mood, and 9 = highest mood).

Self-focus During the SART task participants were asked to indicate their current level of self-focus on a single Likert type scale of 0 to 9 (where 0 = no self-focus, completely focused on the task, and 9 = very self-focussed).
Manipulation checks

Current Mood. Participants were asked to indicate their current mood (please identify your current mood) on a single Likert type scale of 1 to 10 (where 1 = lowest mood, and 10 = highest mood).

Current feelings of depression. A Visual Analogue Scale (VAS) for feelings of depression was used to assess current depressed mood both before and after the rumination inductions. The participant was asked to indicate how depressed they are feeling along a continuum of 0-100 where 0 = no depressed mood, and 100 = severe depressed mood).

Design and procedure

The current study had a mixed design with two main independent variables: Mood induction (low versus neutral) and trait rumination (low versus high). The dependent variables were current mood and self-focus during the modified SART. Participants who expressed interest in the study were invited to attend an appointment at the University of Exeter. Upon arrival participants were provided with an information sheet about the study, and the procedures were verbally described. Informed written consent was obtained prior to beginning the study. Participants were then asked to complete the Beck Depression Inventory (BDI II), the Ruminative Response Scale (RRS), a demographic information form, the visual analogue scale for feelings of depression and the measure of current mood in order to obtain baseline measures of mood.

Participants were then randomly allocated to either a negative mood induction group or a control group with a neutral mood induction, and informed that we were
interested in studying the relationship between different types of music and performance on a subsequent cognitive task. Participants completed the seven minute mood induction whilst the experimenter waited outside the room, followed by the current mood and VAS for feelings of depression manipulation checks. Immediately following this, participants were asked to complete the SART task (McVay & Kane, 2009), which lasted approximately 55 minutes. The experimenter left the room and waited outside for the duration of this task. Upon completion of the SART task, participants were asked to indicate their current mood and current feelings of depression on the VAS scale.

All participants then completed a distraction task (Morrow & Nolen-Hoeksema, 1990) in order to neutralize their mood. Participants were asked to focus on non self-relevant images for 8 minutes (e.g. 'think about a fan slowly rotating back and forth', 'think about the layout of your shopping centre'). Previous research has found that individuals who engaged in active, distracting tasks following a negative mood induction experienced a reduction in sadness to pre mood-induction levels (Morrow & Nolen-Hoeksema, 1990). Finally, participants were debriefed and thanked for taking part.

Statistical analysis

The data were analyzed in IBM SPSS statistics 19 with mixed measures ANOVAs, t tests and simple tests of main effects for current mood and self-focus across the four blocks in the modified SART. Data were checked for accuracy, missing data, outliers and normality. Mood scores demonstrated substantial negative skewness in block 1, block 2, block 3 and block 4. Log transformations were used to normalize this variable in each block. Data for one participant was incomplete due to a malfunction of the computer during the modified SART.
Results

Descriptive statistics Of the total sample, 89.7% (N = 61) were female; 34 completed the low mood induction and 34 completed the neutral mood induction. Mean trait rumination (RRS) was 41.70 (SD = 11.32). Because a wide range of scores on the RRS was not achieved through recruitment, the median of the upper third quartile (51.25) of trait rumination was used as a cut off to define high versus low trait rumination in participants. This resulted in 18 participants in the high rumination group, and 50 in the low rumination group. The two mood induction groups did not differ significantly in trait rumination scores, $t(66) = -1.09, p = .28$.

Manipulation checks; effects of mood induction on current mood and feelings of depression

2 (time: pre mood induction and post mood induction) x 2 (condition: low mood induction and neutral mood induction) mixed ANOVAs were used to examine the effect of mood induction on levels of current mood, feelings of depression. There was a significant main effect of time on current mood, $F(1, 67) = 37.06, p < 0.001$, reflecting lower mood overall from pre induction ($M = 6.83$, $SD = 1.12$) to post mood induction ($M = 6.02$, $SD = 1.54$). However, no significant time x mood induction interaction was found, demonstrating no significant differences between the neutral or low mood groups pre or post induction.

For feelings of depression (VAS), the ANOVA revealed no significant main effect of time. However, a significant two-way time by induction type interaction was found, $F(1, 67) = 4.22, p = 0.04$. Contrary to expectations, a one way repeated measures ANOVA revealed a trend approaching significance in the neutral mood condition, $F(1, 33) = 3.36, p = .07$, but not in the low mood condition, reflecting a decrease in reported feelings of
depression from pre induction ($M = 12.00, SD = 18.02$) to post induction ($M = 6.30, SD = 9.21$) in the neutral mood induction condition. Thus, the low mood induction did not significantly decrease reports of current mood or increase feelings of depression compared to the neutral mood induction.

*Effects of a low mood induction in high trait ruminators*

*Current mood* To test the hypothesis that high trait ruminators will experience a more severe drop in current mood following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction, a 2 (time: pre mood induction, post mood induction) x 2 (mood induction: low, neutral) x 2 (trait rumination: low, high) mixed ANOVA was used. A significant main effect of time, $F(1, 59) = 25.66, p < .001$ reflected a significant overall reduction in mood from pre induction ($M = 6.84, SD = 1.11$) to post induction ($M = 6.03, SD = 1.55$), across conditions. A marginally significant main effect of trait rumination was also found, $F(1, 59) = 3.96, p = .051$, demonstrating that high trait ruminators reported lower mood overall ($M = 5.96, SD = 1.14$), compared to low trait ruminators ($M = 6.54, SD = 1.27$).

Contrary to predictions, a three-way time by induction type by trait rumination interaction was not found, $F(1, 59) = 1.79, p = .18$. No other main effects of interactions were found. Thus, high trait ruminators did not differ significantly in their reports of current mood following a low mood induction compared to low trait ruminators, or high and low ruminators following a neutral mood induction.

*VAS for feelings of depression* The 2 x 2 x 2 mixed ANOVA for feelings of depression revealed a significant main effect of trait rumination, $F(1, 60) = 6.08, p = .02$, demonstrating that overall, high trait ruminators reported more feelings of depression ($M = \ldots\ldots$).
14.75, SD = 13.72) compared to low trait ruminators (M = 7.33, SD = 11.59). T tests revealed that high trait ruminators did not report a significant increase in feelings of depression from pre to post mood induction, \( t(15) = 1.13, p = .28 \), \( (M \text{ increase} = 2.75, SD = 9.72) \) compared to low trait ruminators, \( t(47) = .30, p = .76 \) \( (M \text{ increase} = .50, SD = 11.58) \). Again, a three-way time by induction type by trait rumination interaction was not found, \( F(1, 60) = 2.76, p = .10 \). No other main effects or interactions were found. Thus, high trait ruminators did report more feelings of depression overall. However, high trait ruminators did not differ significantly in their reports of feelings of depression following a low mood induction compared to low trait ruminators, or high and low ruminators following a neutral mood induction.

**Self-focus** A 2 (mood induction: low, neutral) by 2 (trait rumination: low, high) between subjects ANOVA was used to test the hypothesis that high trait ruminators will report more self-focus immediately following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. There was no main effect of mood induction, \( F(1, 62) = .22, p = .64 \), or trait rumination, \( F(1, 62) = .06, p = .81 \), on reports of self-focus, and contrary to predictions, there was not a significant mood induction by trait rumination interaction, \( F(1, 62) = .45, p = .51 \). Thus, high trait ruminators in the low mood induction condition did not report significantly greater levels of self-focus that low trait ruminators in a low mood induction, or high or low ruminators in a neutral mood induction condition.

**Current mood during the modified SART**

The low mood induction did not result in a significant reduction in current mood in high, compared to low trait ruminators. Thus, it was not possible to test for interaction effects of mood induction and trait rumination on time taken to return to baseline levels of
mood. However, because all participants reported a drop in mood from baseline levels following the mood induction, it was possible to examine whether high ruminators would take longer to return to baseline levels of mood compared to low ruminators during the modified SART. A 2 (mood induction: low, neutral) x 2 (trait rumination: low, high) x 4 (time: block 1, block 2, block 3, block 4) mixed ANOVA examined the effects of the mood induction and trait rumination on current mood during the modified SART. There was a significant main effect of time, $F(3, 174) = 3.42, p = .02$, demonstrating an overall effect of time on current mood. A significant three way time by mood induction by trait rumination interaction was not observed, $F(3, 174) = .67, p = .57$, suggesting that conditions did not differ significantly in their reported current mood across the four time points. No other main effects or interactions were found.

**Self-focus during the modified SART**

Again, a prerequisite for testing hypothesis three is that high trait ruminators will report more self-focus following a low mood induction compared to low trait ruminators, and participants in a neutral mood induction. Thus, it was not possible to examine whether high trait ruminators in a low mood induction condition would report more self-focus for a longer duration. However, a 2 (mood induction: low, neutral) x 2 (trait rumination: low, high) x 4 (time: block 1, block 2, block 3, block 4) mixed ANOVA was used to examine whether the conditions differed in reported self-focus across the four time points. There was a significant effect of trait rumination, $F(1, 57) = 5.12, p = .02$, reflecting that high trait ruminators reported more self-focus overall (M = 5.45, SD = 1.63), compared to low trait ruminators (M = 4.12, SD = 1.58). There was also a significant main effect of time, $F(3, 171) = 4.03, p = .008$, again reflecting an overall effect of time on reported self-focus.
A significant two way time by trait rumination interaction, $F(3, 171) = 3.25, p = .02$, also demonstrated differences in mean reported self-focus between high and low ruminators across the modified SART (Table i). Simple effects analyses revealed that the high trait rumination condition reported more self-focus in block two, $F(1, 61) = 6.75, p = .01$ block three, $F(1, 61) = 9.98, p = .002$, and block 4, $F(1, 61) = 8.60, p = .005$ (Figure i). The groups did not differ significantly in block one, $F(1, 61) = 2.23, p = .14$. Self-focus also increased significantly between block one and block two in the high trait rumination group, $t(13) = 2.95, p = .047$. Thus, high trait ruminators became significantly more self-focused than low trait ruminators during the task, and stayed more self-focused than the low trait ruminators for the remainder of the task.

Figure i:

Mean reported self-focus by time
Discussion

This study tested the prediction that individual differences in trait rumination would interact with an experimentally induced negative mood state to predict the severity and duration of state mood and state rumination. Contrary to our hypothesis, whilst high trait ruminators reported lower current mood and feelings of depression overall, they did not differ significantly in their reports of current mood or feelings of depression following a low mood induction compared to low trait ruminators, or participants following a neutral mood induction. Nor did high trait ruminators take longer to return to baseline levels of current mood following a mood induction. Further, high trait ruminators did not report greater levels of self-focus immediately following the low mood induction compared to low trait ruminators. However, in partial support of hypothesis four, individual differences in trait rumination were found to be associated with differential levels of self-focus during the modified SART.

This study examined whether a negative mood state may be a mechanism driving the reported effects of trait rumination on state rumination and mood. To our knowledge, this is the first study to directly examine whether an experimentally induced negative mood state differentially impacts the severity and duration of ‘in the moment’ emotional responses of high trait ruminators compared to low trait ruminators. Previous research has indicated that experimentally induced rumination increases depressed mood (e.g. Nolen-Hoeksema & Morrow, 1993) and that individuals with a greater tendency to ruminate in a stable, trait like manner experience longer and more severe periods of depressed mood compared to those who manage their mood with distracting activities (e.g. Nolen-Hoeksema, Parker & Larson, 1994). The present study however, failed to demonstrate that
experimentally induced low mood increased negative affect and self-focus in high trait ruminators.

Effectiveness of the musical mood induction

It is noteworthy that the negative mood induction did not successfully induce a low mood state compared to the neutral mood induction, as reflected by no mean differences in reported current mood or feelings of depression from pre induction to post induction. Rather, all participants reported a significant decrease in current mood from pre to post induction, regardless of induction type. This demonstrates that the low mood induction was not successful in this study. Previous studies have demonstrated the effectiveness of the musical mood induction used in this study in altering mood states (Clark, 1983) and other research has shown that musical mood inductions are as effective, if not more so (Westermann et al., 1996; Västfjäll, 2002) than the traditional Velten method (Velten, 1968), in which participants read 60 self-referent statements (e.g. "I have too many bad things in my life"). However, in this study the induction was unsuccessful, and may have benefitted from the inclusion of the Velten method in combination with the musical induction. Thus, it is not possible to draw conclusions from this data as to whether the relationship between trait rumination and state ruminative thinking or state mood is driven by the introduction of a negative mood state. As this question has as yet received little attention, future research should attempt to replicate these methods with a more effective mood induction procedure.

However, this study did demonstrate that observed decreases in mood do not take longer to return to baseline in high trait ruminators compared to low ruminators. In this study, all participants reported a consistently lower mood throughout the duration of the modified SART. Whilst we can offer no clear explanation as to why all participants
reported a decrease in their current mood throughout the SART, it is speculated that this effect may be a result of the nature of the task. Indeed, all participants also reported a subsequent significant decrease in mood from post induction to block 1 of the modified SART, suggesting that this task may not be an appropriate means of assessing mood, perhaps either due to its length or the lack of stimulation it offers, and potentially the resulting physical discomfort of completing such a long task. Thus the modified SART has shown to be effective in assessing mind wandering and self-focus, but may be less able to assess current mood states due to the apparent negative impact on mood from completing the task itself. Notably, previous research has also failed to find effects on negative affect during the modified SART (e.g. Roberts et al., 2013).

Self-focus in high compared to low trait ruminators

Previous research has indicated a relationship between the tendency to ruminate and state ruminative behaviour (e.g. Moberly & Watkins, 2008; Roberts et al., 2013). Similarly, this study found that individuals higher in trait rumination reported more self-focus overall during the modified SART. Self-focus also increased significantly for high trait ruminators during the task, and remained significantly higher than that of low trait ruminators for the duration of the task, without returning to baseline levels. This is consistent with previous findings, and the notion that trait rumination is related to difficulty in disengaging from ruminative content (Joormann, 2005). This is further supported by the finding that increased self-focus in high trait ruminators persisted in the modified SART from block 2 through to the end of the task.
These findings are noteworthy because they provide an indication that trait rumination may be predictive of the temporal course of state rumination in particular contexts and settings. The modified SART uses a simple go/no-go paradigm to provide a means of assessing attentional lapses, thus simulating a situation where increased mind wandering is more likely. It is speculated that differences between high and low trait ruminators may be observed in contexts which allow for potential mind wandering. In particular, high trait ruminators may self-focus to a greater extent and for a longer duration in specific everyday contexts compared to low trait ruminators, who will remain more focussed on the task at hand. Future research could examine the impact of contextual factors and everyday events and situations on the relationship between trait and state rumination. Wood, Saltzberg & Goldsamt (1990) have previously demonstrated that a negative mood induction, but not a positive mood induction, increased self-focused attention in undergraduates. In this situation, Wood and colleagues argue that the negative mood induction may have resulted in a search for causes of the low mood, and triggered attempts to repair the negative mood via behavioural coping strategies. The present study has demonstrated that a low mood induction is not necessary to induce self-focussed attention, if the individual already has a greater tendency to ruminate and the context facilitates such a thinking style.

**Limitations**

A number of limitations prevent clear conclusions being drawn from this study. First, the mood induction was not successful. The low mood induction did not significantly reduce mood, and the neutral mood induction was found to decrease feelings of depression from pre to post induction. As such, future research would benefit from a stronger low mood induction, perhaps incorporating the Velten method with the musical procedure, and
the neutral mood induction should be a well validated procedure that may benefit from additional pilot testing with the sample population to ensure it does not significantly impact mood.

Second, a wide range of scores on the RRS was not achieved through recruitment. Consequently, the median of the upper third quartile of trait rumination was used as a cut off to define high versus low trait rumination in participants, rather than using a median split. The final analysed sample consisted of 18 participants in the high rumination group, and 50 in the low rumination group. This resulted in an underpowered sample in the high trait rumination group, which may have inhibited our potential to find significant effects. Thus, future research should ensure the inclusion of a recruitment criterion on the basis of RRS scores.

Third, this study would have benefitted from a baseline assessment of self-focus in order to effectively assess whether self-focus increased from pre to post mood induction differentially in high compared to low trait ruminators. By only assessing self-focus after the induction, this study was limited to testing whether levels of self-focus were higher following the mood induction in high trait ruminators. Fourth, our sample consisted mainly of students and so it is difficult to generalise the findings of this study to a wider population. Further, it will be important to replicate this study with a clinical sample in order to achieve a wider range and greater variability in trait rumination. Finally, whilst our measure of state rumination taps into an important aspect of ruminative thinking, self-focus, we did not measure other important components of state ruminative behaviour. Future research could assess multiple aspects of state rumination such as evaluation, analysis, and focussing on emotions and problems.
Conclusions

In conclusion, this study failed to demonstrate that a state of induced negative affect is a mechanism driving the effect of trait rumination on state ruminative thinking, and state mood. It is possible that our inability to find significant effects was due to the failure of the mood inductions, and a lack of power to find significant differences due to a small sample of high trait ruminators. However, this study has demonstrated that high trait ruminator’s exhibit increases in self-focus during a context that facilitates mind wandering. Further, this self-focus persists for considerable periods of time compared to low ruminators. This supports the notion that individual differences in trait rumination are associated with different temporal processes in state rumination, and differential levels of state rumination. Future research should explore whether these differences are context specific.
Appendix 1.1: A priori power analysis

Prior to data collection for the study an a priori power analysis was carried out using G* Power application in order to estimate the number of participants required to minimize the risk of type II error. To estimate the required sample size the following assumptions were applied; small to medium effect size ($f^2 = .33$), $\alpha = .05$, $\beta = .80$, two variables being tested and four independent variables in total, with four repeated measures. It was estimated from this power analysis that 68 participants were required (Figure 7.2).

Figure ii

A Priori power analysis
Appendix 1.2: State mood transformation in blocks one to four of the modified SART

An important assumption of ANOVA is that the response variable residuals are normally distributed. Aggregated scores for state mood demonstrated moderate to substantial negative skewness in each block of the modified SART (block 1, $z_{\text{skewness}} = - .74$, $z_{\text{kurtosis}} = .47$; block 2, $z_{\text{skewness}} = -.90$, $z_{\text{kurtosis}} = .71$; block 3, $z_{\text{skewness}} = -1.24$, $z_{\text{kurtosis}} = 1.63$; block 4, $z_{\text{skewness}} = -.77$, $z_{\text{kurtosis}} = 1.50$). Log transformations were used to address this issue and normalize the variable at block 1; $z_{\text{skewness}} = -.14$, $z_{\text{kurtosis}} = .92$, block 2; $z_{\text{skewness}} = .18$, $z_{\text{kurtosis}} = .09$, block 3; $z_{\text{skewness}} = .52$, $z_{\text{kurtosis}} = .71$ and block 4, $z_{\text{skewness}} = -.61$, $z_{\text{kurtosis}} = 2.66$. The log transformed data was approximately symmetrical, with the exception of state mood in block 4, which remained moderately skewed. (Figures iii to vi).

Figure iii:
Distribution of block 1 state mood before (left) and after (right) Log transformation
Figure iv:
Distribution of block 2 state mood before (left) and after (right) Log transformation

Figure v:
Distribution of block 3 state mood before (left) and after (right) Log transformation
Figure vi:

Distribution of block 4 state mood before (left) and after (right) Log transformation
Appendix 2: Thesis Measures and induction tasks

MOOD DISORDERS CENTRE

BECK DEPRESSION INVENTORY - II (BDI-II)

Please read each group of statements carefully, then pick out the **one statement** in each group which best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked.

If several statements in the group seem to apply equally well, simply circle the statement which has the largest number. Be sure that you do **not** circle more than one statement for Item 16 (change in sleeping pattern) and Item 18 (change in appetite.)

1 **Sadness**
   0 I do not feel sad.  
   1 I feel sad much of the time.  
   2 I am sad all the time.  
   3 I am so sad or unhappy that I can't stand it.

2 **Pessimism**
   0 I am not discouraged about my future.  
   1 I feel more discouraged about my future than I used to be.  
   2 I do not expect things to work out for me.  
   3 I feel my future is hopeless and will only get worse.

3 **Past Failure**
   0 I do not feel like a failure.  
   1 I have failed more than I should have.  
   2 As I look back, I see a lot of failures.  
   3 I feel I am a total failure as a person.

4 **Loss of Pleasure**
   0 I get as much pleasure as I ever did from the things I enjoy.  
   1 I don't enjoy things as much as I used to.  
   2 I get very little pleasure from the things I used to enjoy.  
   3 I can't get any pleasure from the things I used to enjoy.

5 **Guilty Feelings**
   0 I don't feel particularly guilty.  
   1 I feel guilty over many things I have done or should have done.  
   2 I feel quite guilty most of the time.  
   3 I feel guilty all of the time.

6 **Punishment Feelings**
   0 I don't feel I am being punished.  
   1 I feel I may be punished.  
   2 I expect to be punished.  
   3 I feel I am being punished.

7 **Self Dislike**
   0 I feel the same about myself as ever.  
   1 I have lost confidence in myself.  
   2 I am disappointed in myself.  
   3 I dislike myself.

8 **Self Criticalness**
   0 I don't criticize or blame myself more than usual.  
   1 I am more critical of myself than I used to be.  
   2 I criticize myself for all of my faults.  
   3 I blame myself for everything bad that happens.

9 **Suicidal Thoughts or Wishes**
   0 I don't have any thoughts of killing myself.  
   1 I have thoughts of killing myself, but I would not carry them out.  
   2 I would like to kill myself.  
   3 I would kill myself if I had the chance.

10 **Crying**
    0 I don't cry any more than I used to.  
    1 I cry more than I used to.  
    2 I cry over every little thing.  
    3 I feel like crying but I can't.

11 **Agitation**
   0 I am no more restless or wound up than usual.  
   1 I feel more restless or wound up than usual.  
   2 I am so restless or agitated that it's hard to stay still.  
   3 I am so restless or agitated I have to keep moving or doing something.
12 Loss of Interest
0 I have not lost interest in other people or activities.
1 I am less interested in other people or things than before.
2 I have lost most of my interest in other people or things.
3 It’s hard to get interested in anything.

13 Indecisiveness
0 I make decisions about as well as ever.
1 I find it more difficult to make decisions than usual.
2 I have much greater difficulty in making decisions than I used to.
3 I have trouble making any decisions.

14 Worthlessness
0 I do not feel I am worthless.
1 I don’t consider myself as worthwhile or useful as I used to.
2 I feel more worthless as compared to other people.
3 I feel utterly worthless.

15 Loss of Energy
0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don’t have enough energy to do very much.
3 I don’t have enough energy to do anything.

16 Change in Sleeping Pattern
0 I have not experienced any change in my sleeping pattern.

1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual.

2a I sleep a lot more than usual.
2b I sleep a lot less than usual.

3a I sleep most of the day.
3b I wake up 1-2 hours early and can’t get back to sleep.

17 Irritability
0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18 Change in Appetite
0 I have not experienced any change in my appetite.

1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.

2a My appetite is much less than before.
2b My appetite is much greater than usual.

3a I have no appetite at all.
3b I crave food all the time.

Concentration Difficulty
0 I can concentrate as well as ever.
1 I can’t concentrate as well as usual.
2 It’s hard to keep my mind on anything for very long.
3 I find I can’t concentrate on anything.

20 Tiredness or Fatigue
0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

21 Loss of Interest in Sex
0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.
EDINBURGH POSTNATAL DEPRESSION SCALE (EPDS)

As you have recently had a baby, we would like to know how you are feeling. Please tick the box to the answer which comes closest to how you have felt IN THE PAST 7 DAYS, not just how you feel today.

In the past 7 days …

1. I have been able to laugh & see the funny side of things
   0) As much as I always could
   1) Not quite as much now
   2) Definitely not as much now
   3) Not at all

2. I have looked forward with enjoyment to things
   ☐ As much as I ever did
   ☐ Rather less than I used to
   ☐ Definitely less than I used to
   ☐ Hardly at all

3. I have blamed myself unnecessarily when things went wrong
   ☐ Yes, most of the time
   ☐ Yes, some of the time
   ☐ Not very often
   ☐ No, never

4. I have been anxious and worried for not good reason
   ☐ No, not at all
   ☐ Hardly ever
   ☐ Yes, sometimes
   ☐ Yes, very often

5. I have felt scared or panicky for no good reason
   ☐ Yes, quite a lot
   ☐ Yes, sometimes
   ☐ No, not much
   ☐ No, not at all

6. * Things have been getting on top of me
   ☐ Yes, most of the time I haven’t been able to cope
   ☐ Yes, sometimes I haven’t been coping as well as usual
   ☐ No, most of the time I coped quite well
   ☐ No, I have been coping as well as ever

7. * I have been unhappy that I have had difficulty sleeping
   ☐ Yes, most of the time
   ☐ Yes, sometimes
   ☐ Not very often
   ☐ No, not at all

8. * I have felt sad or miserable
   ☐ Yes, most of the time
   ☐ Yes, quite often
   ☐ Not very often
   ☐ No, not at all
9. * I have been so unhappy that I have been crying
☐ Yes, most of the time
☐ Yes, quite often
☐ Only occasionally
☐ No, never

10. * The thought of harming myself has occurred to me
☐ Yes, quite often
☐ Sometimes
☐ Hardly ever
☐ Never
**PRQ**

Name ___________________________  Baby's age ___________  Date ________________

Please indicate how often the following are true for you. There are no 'right' or 'wrong' answers. Choose the answer which seems right in your recent experience:

<table>
<thead>
<tr>
<th></th>
<th>Always</th>
<th>Very often</th>
<th>Quite often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
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<tbody>
<tr>
<td>I feel close to my baby</td>
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<tr>
<td>I wish the old days when I had no baby would come back</td>
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<tr>
<td>I feel distant from my baby</td>
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<tr>
<td>I love to cuddle my baby</td>
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<tr>
<td>I regret having this baby</td>
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<tr>
<td>The baby doesn't seem to be mine</td>
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<tr>
<td>My baby winds me up</td>
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<tr>
<td>I love my baby to bits</td>
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<tr>
<td>I feel happy when my baby smiles or laughs</td>
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<tr>
<td>My baby irritates me</td>
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<tr>
<td>I enjoy playing with my baby</td>
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<tr>
<td>My baby cries too much</td>
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<td>I feel trapped as a mother</td>
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<tr>
<td>I feel angry with my baby</td>
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<tr>
<td>I resent my baby</td>
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<tr>
<td>My baby is the most beautiful baby in the world</td>
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<tr>
<td>I wish my baby would somehow go away</td>
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<td>I have done harmful things to my baby</td>
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<td>My baby makes me feel anxious</td>
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<tr>
<td>I am afraid of my baby</td>
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<td>My baby annoys me</td>
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<tr>
<td>I feel confident when caring for my baby</td>
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<tr>
<td>I feel the only solution is for someone else to look after my baby</td>
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<td>I feel like hurting my baby</td>
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<tr>
<td>My baby is easily comforted</td>
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Maternal Infant Responsiveness Instrument

Instructions: Please answer the following statements as honestly as you can. Circle the answer that best fits your level of agreement.

1. I have made faces and smiled at my baby and watched for my baby's response to me.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

2. I believe my baby wants me to touch her/him too often.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

3. I have seen my baby respond to my playing with him/her.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

4. I believe that I can comfort my baby when she/he cries.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

5. I have seen my baby respond to my talking to him/her.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

6. I believe I know when my baby wants to play.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

7. I have seen my baby respond to my comforting him/her.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

8. I believe I know when my baby wants me to feed him/her.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

9. I have watched my baby respond to my feeding him/her.
   Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

10. I think I sometimes respond slowly to my baby.
    Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree

11. I believe my baby responds well to my holding him/her.
    Strongly agree    Agree    Somewhat agree    Disagree    Strongly disagree
12. I have watched my baby respond to my touching him/her.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

13. I believe my baby wants me to play with her/him.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

14. I am afraid of my baby’s appearance.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

15. I believe my baby wants me to comfort her/him too often.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

16. I believe my baby wants me to talk to her/him.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

17. I feel good about how I respond to my baby.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

18. I feel good about how my baby responds to me.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

19. I believe I know when my baby needs me to feed him/her.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

20. I feel afraid to care for my baby.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

21. I like the way my baby responds to me when I play with him/her.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree

22. I believe my baby wants me to hold her/him too often.

Strongly agree  Agree  Somewhat agree  Disagree  Strongly disagree
**Responses to Depression**

People think and do many different things when they feel down, sad or depressed. Please read each of the items below and indicate whether you never, sometimes, often, or always think or do each one when you feel down, sad or depressed. Please indicate what you *generally* do, not what you think you should do.

<table>
<thead>
<tr>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
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</table>

1. Think about how alone you feel.
2. Think “I won’t be able to do my job/work because I feel so bad”
3. Think about your feelings of fatigue and achiness
4. Think about how hard it is to concentrate
5. Think about how passive and unmotivated you feel
6. Analyse recent events to try and understand why you are depressed
7. Think about how you don’t seem to feel anything anymore
8. Think “Why can’t I get going?”
9. Think “Why do I always react this way?”
10. Go away by yourself and think about why you feel this way
11. Write down what you are thinking about and analyse it
12. Think about a recent situation, wishing it would have gone better
13. Think “Why do I have problems other people don’t have?”
14. Think about how sad you feel
15. Think about all your shortcomings, failings, faults and mistakes
16. Think about how you don’t feel up to doing anything
17. Analyse your personality to try and understand why you are depressed
18. Go someplace alone to think about your feelings
19. Think about how angry you are with yourself
20. Listen to sad music
21. Isolate yourself and think about the reasons why you feel sad
22. Try to understand yourself by focusing on your depressed mood
23. Think “What am I doing to deserve this?”
24. Think “I won’t be able to concentrate if I keep feeling this way”.
25. Think “Why can’t I handle things better?”

Thank you for filling in this questionnaire.
Infant Behavior Questionnaire - Revised

Subject No. _______________  Date of Baby’s Birth _____ ____

year

Today’s Date _______________  Age of Child _____ ____

mos.  weeks

Sex of Child _______________  

INSTRUCTIONS:
Please read carefully before starting:

As you read each description of the baby’s behavior below, please indicate how often the baby did this during the LAST WEEK (the past seven days) by circling one of the numbers in the left column. These numbers indicate how often you observed the behavior described during the last week.

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Very Rarely</td>
<td>Less Than Half the Time</td>
<td>About Half the Time</td>
<td>More Than Half the Time</td>
<td>Almost Always</td>
<td>Always</td>
</tr>
</tbody>
</table>

The “Does Not Apply” (X) column is used when you did not see the baby in the situation described during the last week. For example, if the situation mentions the baby having to wait for food or liquids and there was no time during the last week when the baby had to wait, circle the (X) column. “Does Not Apply” is different from “Never” (1). “Never” is used when you saw the baby in the situation but the baby never engaged in the behavior listed during the last week. For example, if the baby did have to wait for food or liquids at least once but never cried loudly while waiting, circle the (1) column.

Please be sure to circle a number for every item.
### One Week Time Span

How often did your baby:

1. make talking sounds when s/he was ready for more food?

2. seem angry (crying and fussing) when you left her/him in the crib?

3. seem contented when left in the crib?

4. cry or fuss before going to sleep for naps?

5. look at pictures in books and/or magazines for 5 minutes or longer at a time?

6. stare at a mobile, crib bumper or picture for 5 minutes or longer?

7. play with one toy or object for 5-10 minutes?

8. play with one toy or object for 10 minutes or longer?

9. laugh aloud in play?

10. repeat the same movement with an object for 2 minutes or longer (e.g., putting a block in a cup, kicking or hitting a mobile)?

11. smile or laugh after accomplishing something (e.g., stacking blocks, etc.)?

12. smile or laugh when given a toy?

13. enjoy being read to?

14. enjoy hearing the sound of words, as in nursery rhymes?

15. enjoy gentle rhythmic activities, such as rocking or swaying?

16. enjoy being tickled by you or someone else in your
family?

1 2 3 4 5 6 7 X . . . . (17) enjoy the feel of soft blankets?

1 2 3 4 5 6 7 X . . . . (18) enjoy being rolled up in a warm blanket?

<table>
<thead>
<tr>
<th>(1) Never</th>
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<th>(4) About Half the Time</th>
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<th>(7) Always</th>
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</tr>
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</table>

1 2 3 4 5 6 7 X . . . . (19) enjoy listening to a musical toy in a crib?

1 2 3 4 5 6 7 X . . . . (20) look up from playing when the telephone rang?

1 2 3 4 5 6 7 X . . . . (21) protest being placed in a confining place (infant seat, play pen, car seat, etc)?

1 2 3 4 5 6 7 X . . . . (22) startle at a sudden change in body position (for example, when moved suddenly)?

1 2 3 4 5 6 7 X . . . . (23) move quickly toward new objects?

1 2 3 4 5 6 7 X . . . . (24) show a strong desire for something s/he wanted?

1 2 3 4 5 6 7 X . . . . (25) watch adults performing household activities (e.g., cooking, etc.) for more than 5 minutes?

1 2 3 4 5 6 7 X . . . . (26) squeal or shout when excited?

1 2 3 4 5 6 7 X . . . . (27) notice low-pitched noises (e.g. air conditioner, heating system, or refrigerator running or starting up)?

1 2 3 4 5 6 7 X . . . . (28) notice a change in light when a cloud passed over the sun?

1 2 3 4 5 6 7 X . . . . (29) notice the sound of an airplane passing overhead?

1 2 3 4 5 6 7 X . . . . (30) notice a bird or a squirrel up in a tree?

1 2 3 4 5 6 7 X . . . . (31) notice fabrics with scratchy texture (e.g., wool)?

1 2 3 4 5 6 7 X . . . . (32) appear sad for no apparent reason?

During feeding, how often did the baby:

1 2 3 4 5 6 7 X . . . . (33) lie or sit quietly?
1 2 3 4 5 6 7 X . . . . (34) squirm or kick?
1 2 3 4 5 6 7 X . . . . (35) wave his/her arms?

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<tr>
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<th>(7) Always</th>
<th>(X) Does Not Apply</th>
</tr>
</thead>
</table>

When going to sleep at night, how often did your baby:
1 2 3 4 5 6 7 X . . . . (36) fall asleep within 10 minutes?
1 2 3 4 5 6 7 X . . . . (37) have a hard time settling down to sleep?
1 2 3 4 5 6 7 X . . . . (38) settle down to sleep easily?

When being dressed or undressed during the last week, how often did the baby:
1 2 3 4 5 6 7 X . . . . (39) squirm and/or try to roll away?
1 2 3 4 5 6 7 X . . . . (40) smile or laugh?
1 2 3 4 5 6 7 X . . . . (41) coo or vocalize?

When put into the bath water, how often did the baby:
1 2 3 4 5 6 7 X . . . . (42) smile?
1 2 3 4 5 6 7 X . . . . (43) laugh?

When tossed around playfully how often did the baby:
1 2 3 4 5 6 7 X . . . . (44) smile?
1 2 3 4 5 6 7 X . . . . (45) laugh?

During a peekaboo game, how often did the baby:
1 2 3 4 5 6 7 X . . . . (46) smile?
1 2 3 4 5 6 7 X . . . . (47) laugh?

How often did your baby enjoy bouncing up and down:
1 2 3 4 5 6 7 X . . . . (48) while on your lap?
1 2 3 4 5 6 7 X . . . . (49) on an object, such as a bed, bouncer chair, or toy?

When being held, how often did the baby:
1 2 3 4 5 6 7 X . . . (50) pull away or kick?
1 2 3 4 5 6 7 X . . . (51) seem to enjoy him/herself?

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<td>Always</td>
<td>Does Not Apply</td>
</tr>
</tbody>
</table>

When the baby wanted something, how often did s/he:

1 2 3 4 5 6 7 X . . . (52) become upset when s/he could not get what s/he wanted?
1 2 3 4 5 6 7 X . . . (53) have tantrums (crying, screaming, face red, etc.) when s/he did not get what s/he wanted?

When placed in an infant seat or car seat, how often did the baby:

1 2 3 4 5 6 7 X . . . (54) wave arms and kick?
1 2 3 4 5 6 7 X . . . (55) squirm and turn body?

How often did your baby make talking sounds when:

1 2 3 4 5 6 7 X . . . (56) riding in a car?
1 2 3 4 5 6 7 X . . . (57) riding in a shopping cart?
1 2 3 4 5 6 7 X . . . (58) you talked to her/him?

When rocked or hugged, in the last week, how often did your baby:

1 2 3 4 5 6 7 X . . . (59) seem to enjoy her/himself?
1 2 3 4 5 6 7 X . . . (60) seem eager to get away?
1 2 3 4 5 6 7 X . . . (61) While being fed in your lap, how often did the baby seem eager to get away as soon as the feeding was over?
1 2 3 4 5 6 7 X . . . (62) After sleeping, how often did the baby cry if someone didn’t come within a few minutes?
1 2 3 4 5 6 7 X . . . (63) When put down for a nap, how often did your baby settle down quickly?
1 2 3 4 5 6 7 X . . . (64) When it was time for bed or a nap and your baby did not want to go, how often did s/he whimper or sob?
1 2 3 4 5 6 7 X . . . (65) When face was washed, how often did the baby smile or laugh?

1 2 3 4 5 6 7 X . . . (66) When hair was washed, how often did the baby vocalize?

1 2 3 4 5 6 7 X . . . (67) When playing quietly with one of her/his favorite toys, how often did your baby enjoy lying in the crib for more than 5 minutes?

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<th>(7) Always</th>
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</tr>
</thead>
</table>

1 2 3 4 5 6 7 X . . . (68) When your baby saw a toy s/he wanted, how often did s/he get very excited about getting it?

1 2 3 4 5 6 7 X . . . (69) When given a new toy, how often did your baby immediately go after it?

1 2 3 4 5 6 7 X . . . (70) When placed on his/her back, how often did the baby squirm and/or turn body?

1 2 3 4 5 6 7 X . . . (71) When frustrated with something, how often did your baby calm down within 5 minutes?

1 2 3 4 5 6 7 X . . . (72) When your baby was upset about something, how often did s/he stay upset for up to 20 minutes or longer?

1 2 3 4 5 6 7 X . . . (73) When being carried, how often did your baby push against you until put down?

1 2 3 4 5 6 7 X . . . (74) When tired, how often did your baby show distress?

1 2 3 4 5 6 7 X . . . (75) At the end of an exciting day, how often did your baby become tearful?

**Two Week Time Span**

When introduced to an unfamiliar adult, how often did the baby:

1 2 3 4 5 6 7 X . . . (76) cling to a parent?

1 2 3 4 5 6 7 X . . . (77) refuse to go to the unfamiliar person?

1 2 3 4 5 6 7 X . . . (78) never “warm up” to the unfamiliar adult?

When you were busy with another activity and your baby was not able to get your attention, how often did s/he:
1 2 3 4 5 6 7 X . . . (79) become sad?

1 2 3 4 5 6 7 X . . . (80) cry?

When singing or talking to your baby, how often did s/he:

1 2 3 4 5 6 7 X . . . (81) soothe immediately?

1 2 3 4 5 6 7 X . . . (82) take more than 10 minutes to soothe?

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<td>Almost Always</td>
<td>Always</td>
<td>Does Not Apply</td>
</tr>
</tbody>
</table>

When showing the baby something to look at, how often did s/he:

1 2 3 4 5 6 7 X . . . (83) soothe immediately?

1 2 3 4 5 6 7 X . . . (84) take more than 10 minutes to soothe?

When patting or gently rubbing some part of the baby’s body, how often did s/he:

1 2 3 4 5 6 7 X . . . (85) soothe immediately?

1 2 3 4 5 6 7 X . . . (86) take more than 10 minutes to soothe?

1 2 3 4 5 6 7 X . . . (87) When in the presence of several unfamiliar adults, how often did the baby continue to be upset for 10 minutes or longer?

1 2 3 4 5 6 7 X . . . (88) When visiting a new place, how often did the baby get excited about exploring new surroundings?

1 2 3 4 5 6 7 X . . . (89) When an unfamiliar adult came to your home or apartment, how often did your baby cry when the visitor attempted to pick her/him up?

1 2 3 4 5 6 7 X . . . (90) When familiar relatives/friends came to visit, how often did your baby get excited?

1 2 3 4 5 6 7 X . . . (91) When rocking your baby, how often did s/he take more than 10 minutes to soothe?
The Social Provisions Scale

Instructions

In answering the next set of questions I am going to ask you, I want you to think about your current relationship with friends, family members, coworkers, community members, and so on. Please tell me to what extent you agree that each statement describes your current relationships with other people. Use the following scale to give me your opinion. (Hand a response card.) So, for example, if you feel a statement is very true of your current relationships, you would tell me “strongly agree”. If you feel a statement clearly does not describe your relationships, you would respond “strongly disagree”. Do you have any questions?

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</table>

1. There are people I can depend on to help me if I really need it. _____
2. I feel that I do not have close personal relationships with other people. _____
3. There is no one I can turn to for guidance in times of stress. _____
4. There are people who depend on me for help. _____
5. There are people who enjoy the same social activities I do. _____
6. Other people do not view me as competent. _____
7. I feel personally responsible for the well-being of another person. _____
8. I feel part of a group of people who share my attitudes and beliefs. _____
9. I do not think other people respect my skills and abilities. _____
10. If something went wrong, no one would come to my assistance. _____
11. I have close relationships that provide me with a sense of emotional security and well-being. _____
12. There is someone I could talk to about important decisions in my life. _____
13. I have relationships where my competence and skills are recognized. _____
14. There is no one who shares my interests and concerns. _____
15. There is no one who really relies on me for their well-being. _____
16. There is a trustworthy person I could turn to for advice if I were having problems. _____
17. I feel a strong emotional bond with at least one other person.

18. There is no one I can depend on for aid if I really need it.

19. There is no one I feel comfortable talking about problems with.

20. There are people who admire my talents and abilities.

21. I lack a feeling of intimacy with another person.

22. There is no one who likes to do the things I do.

23. There are people I can count on in an emergency.

24. No one needs me to care for them.
Rumination thinking task:

“For the next ten minutes I am going to ask you to close your eyes and focus your attention on a problem and difficulty that is still unresolved and bothering you – so this is an ongoing and unresolved concern that has been repeatedly coming into your mind over the past week and causing you to feel negative, sad, down and stressed, When I ask you to begin, please close your eyes and dwell on this current problem or concern, in the way that you usually dwell on and ruminate about unresolved concerns, as intensely as you can, until I ask you to stop and to open your eyes. Examples of the kind of difficulty that I would like you to think about are... “

(example rumination topics)

Example rumination topics:

An ongoing concern about the status of an important relationship, which you feel that you should be managing better
A recent conflict in a close relationship and its impact upon how you have been feeling over the past few weeks
Concerns that you have failed to achieve a goal that is of personal importance to you.
An aspect of parenting you’re concerned you’re not managing well and it is worrying you.
Feeling that you disappoint someone that means a lot to you and that you may lose them as a result of this
Feeling that you do not compare favourably to other parents

“The problem or difficulty that you think about must be one that has been repeatedly troubling you recently and that you have not resolved, that is, it still bothers you and comes repeatedly to mind.
Can you think of a problem or difficulty of this kind to think about?”

If no, remind participant of examples and give them some time to think of a suitable topic. If yes, proceed as follows:

“Would you mind telling me briefly what the problem is?
Now I would like you to evaluate this difficulty using the following scales”

(give participant scales, items are: how important it is to you (0-10), how much it bothers you (0-10), how much did it bother you at the time it was worst (0-10), how much have you been thinking about it in the last week (0-10), how long this has been a difficulty for you (0-10) and how much does this difficulty relate to more general concerns that you have (0-10). Ratings to be used to check the problem is appropriate.

If the participant has not identified an appropriate topic remind participant of the type of concern that we are interested in and the examples and give further time to try and identify a concern of this kind. If appropriate proceed as follows:
Participants will be asked listen to the following instructions through headphones for a period of 10 minutes:

“Please close your eyes and dwell on this current problem or concern, in the way you usually dwell on and ruminate about unresolved concerns, as intensely as you can, until I ask you to stop and open your eyes. Think about the problem and difficulty – what is it?
Focus on how this problem/difficulty bothers and troubles you
Think about what is important about this difficulty in terms of your progress on important personal goals
Focus on how this problem reflects a lack of progress on important personal goals
Think about how this problem/difficulty is still unresolved
Concentrate on the aspects of the problem that reflect unfinished business
Focus on the aspects of the difficulty that repeatedly come to mind
Think about any related concerns and unresolved issues that this problem reminds you of.

Please continue doing this until I come back.”
Control thinking task:

“For the next ten minutes I am going to ask you to close your eyes and focus your attention on a recent problem and difficulty that is now resolved and no longer bothering you – so this is a past and resolved difficulty that has not been coming into your mind over the past week and no longer causes you to feel negative, sad, down or stressed.

When I ask you to begin, please close your eyes and think about this problem or concern, in the way that you usually think about resolved concerns, as intensely as you can, until I ask you to stop and to open your eyes.

Examples of the kind of difficulty that I would like you to think about are... “

(give example rumination topics)

Example control topics:

A concern that you would not achieve a goal that you have now succeeded in achieving.
A past dispute with someone who means a lot to you that has now been resolved and you now feel very positively about this relationship.
An important relationship that you had been finding very stressful, but that you have now learned to manage well.
An aspect of parenting which you previously felt you did not manage well, but that you now manage as well as other people.
A negative event that happened many years ago and that you have now come to terms with and are not troubled by.
A past parenting problem that you have been able to seek social support and share your feelings about, and is now resolved.

“The problem or difficulty that you think about must be one that has not been troubling you recently and that you have now resolved.
Can you think of a problem or difficulty of this kind to think about?”

If no, remind participant of examples and give them some time to think of a suitable topic. If yes, proceed as follows:

“Would you mind telling me briefly what the problem was?
Now I would like you to evaluate this difficulty using the following scales”

(give participant scales, items are: how important it is to you (0-10), how much it bothers you (0-10), how much did it bother you at the time it was worst (0-10), how much have you been thinking about it in the last week (0-10), how long this has been a difficulty for you (0-10) and how much does this difficulty relate to more general concerns that you have (0-10). Ratings to be used to check the problem is appropriate. If not appropriate remind the participant has not identified the type of concern that we are interested in and the examples and give further time to try and identify a concern of this kind. If appropriate proceed as follows:
Participants will be asked listen to the following instructions through headphones for a period of 10 minutes:

“Please close your eyes and think about this past problem or concern, in the way you usually think about past resolved difficulties, as intensely as you can, until I ask you to stop and open your eyes.
Think about the problem and difficulty – what is it?
Focus on what about this problem or difficulty bothered and troubled you in the past
Think about what was important about this difficulty in terms of your progress in terms of your personal goals
Focus on how resolving this problem reflects progress on important personal goals
Think about how this problem/difficulty is now resolved
Concentrate on the aspects of the problem that are now finished and dealt with
Think about any other resolved difficulties that this problem reminds you of.
Please continue doing this until I come back.”
Thinking task problem evaluation scales:

Please evaluate this problem or difficulty by marking the appropriate place on the following scales (1 = least, 10 = most)

How important it is to you
1 2 3 4 5 6 7 8 9 10

How much it bothers you
1 2 3 4 5 6 7 8 9 10

How much did it bother you at the time it was worst?
1 2 3 4 5 6 7 8 9 10

How much have you been thinking about it in the last week?
1 2 3 4 5 6 7 8 9 10

How long this has been a difficulty for you?
1 2 3 4 5 6 7 8 9 10

How much does this problem or difficulty relate to more general concerns that you have?
1 2 3 4 5 6 7 8 9 10
Post induction distraction task:

For the next few minutes, try your best to focus your attention on each of the ideas on the following pages.

Read each item slowly and silently to yourself. As you read the items, use your imagination and concentration to focus your mind on each of the ideas. Spend a few moments visualising and concentrating on each item.

Please continue until the experimenter returns.

*Think about:*  
and imagine a boat slowly crossing the Atlantic

*Think about:*  
the layout of a typical classroom

*Think about:*  
the shape of a large black umbrella

*Think about:*  
the movement of an electric fan on a warm day

*Think about:*  
raindrops sliding down a window pane

*Think about:*  
a double-decker bus driving down a street

*Think about:*  
and picture a full moon on a clear night

*Think about:*  
clouds forming in the sky

*Think about:*  
the layout of the local shopping centre

*Think about:*  
and imagine a plane flying overhead

*Think about:*
fire darting round a log in a fire-place

*Think about:*  
and concentrate on the expression on the face of the *Mona Lisa*

*Think about:*  
the car park at a large supermarket

*Think about:*  
two birds sitting on a tree branch

*Think about:*  
the shadow of a stop sign

*Think about:*  
the layout of the local post office

*Think about:*  
the structure of a high-rise office building

*Think about:*  
and picture the Eiffel Tower

*Think about:*  
and imagine a lorryload of apples

*Think about:*  
the pattern on an Oriental rug

*Think about:*  
the ‘man in the moon’

*Think about:*  
the shape of the continent of Africa

*Think about:*  
a band playing outside

*Think about:*  
a group of polar bears fishing in a stream
Think about:
the shape of Sydney Opera House

Think about:
the shape of Great Britain

Think about:
the way Stonehenge looks at sunset

Think about:
the outline of the Houses of Parliament

Think about:
a train stopped at a station

Think about:
a lone cactus in the desert

Think about:
the shape of the country Italy

Think about:
a row of shampoo bottles on display

Think about:
a petrol station on a major road

Think about:
the fuzz on the shell of a coconut

Think about:
the queens’ head on a stamp

Think about:
a band playing the National Anthem

Think about:
the shape of a cello
Think about:
the birthmark on Gorbachev’s head

Think about:
the shape of the United States of America

Think about:
the baggage claim area at the airport

Think about:
the size of the Statue of Liberty

Think about:
the shape of a cricket bat

Think about:
a freshly painted door

Think about:
the shiny surface of a trumpet

Think about:
a kettle coming to the boil
Appendix 3: Study 4 Ethics documentation

Participant Information Sheet

An investigation into the impact of thinking style on the mother-infant relationship.

There are many factors that may affect how mums and infants get along. One of those factors may be the way people think. We are interested in seeing if the style of thinking a mother has effects how she interacts with her baby. We think different styles of thinking may result in different ways of interacting, and we would like to study those differences.

My name is Michelle Tester-Jones and I am a PhD student in the School of Psychology at the University of Exeter. I am conducting this research with Dr. Heather O’Mahen, Dr. Anke Karl, and Prof. Ed Watkins, all Senior Lecturers within the School of Psychology.

Purpose of the Study

It is the aim of this study to examine how mothers’ thinking styles affect the relationship that they have with their babies. Specifically we are interested in investigating the thinking styles in both mothers who are currently experiencing feelings such as sadness, or have just been feeling a bit low since giving birth and mothers who are not experiencing these feelings.

We intend to use what we learn from this study to further our understanding of the important role that mother-infant interactions play in a child’s development.

The actual study will last approximately an hour and will take place either at the University of Exeter, School of Psychology, or at your home according to which you would prefer. If you choose to participate in your own home, this will comply with the Mood Disorders Centre Lone Workers Policy. The experiment will involve you completing a questionnaire pack followed by a short thought task lasting about 10 minutes during which time you will be asked to focus on yourself and listen to some audio instructions; please ask us to explain this in more detail over the phone if you wish. You will then be asked to interact with your baby as you would at home for a period of 5 minutes. By recording this interaction we hope to learn more about the subtleties involved in mother-infant relationships so that we can understand how thinking styles may affect them. Finally you will be asked to complete an observational task in which you will view a series of infant faces; this should also take no longer than 5 minutes. Prior to being debriefed you will be asked to complete a further 3 short questionnaires.

During some of these tasks you will be asked to concentrate for a short period of time on your own and as such we will ask whether you are happy for your infant to be cared for by the CRB checked researcher whilst you are concentrating. This can either be in the same room or an adjoining one with the door open. If you are not happy to give your consent for this then you can place your infant in a bouncing chair and the researcher will watch over him/her and ensure their safety. If at any time the infant seems distressed the task will be stopped and your son/daughter will be handed back to you immediately.
Why have I been invited?

You have been invited to participate in this study because you were identified by your healthcare visitor/midwife/GP, and have given birth within the last 12 months. We are inviting a cross section of mothers aged between 18-45 years old to be involved in the study.

It is up to you to decide whether or not you and your baby take part. We advise that you take your time and discuss your possible participation with family, friends and your GP/Health visitor.

If you decide to take part you will be given this information sheet to keep and will be asked to sign a consent form. If you do choose to participate you are still free to withdraw at any time, without giving a reason.

What will happen if I do decide to take part?

If you and your baby do decide to take part you will need to telephone Michelle Tester-Jones on 07763857149 or email mct211@exeter.ac.uk. You can ask any questions or voice any concerns you may have.

If you are still interested in taking part then two questionnaires will be administered to you over the telephone which aims to understand how you have been feeling since giving birth. This will take between 10 and 45 minutes of your time and can be completed at a time convenient for you. Following this, a date and time that is convenient for you will be arranged for both you and your baby to come to the University of Exeter, School of Psychology. Alternatively, if you would prefer to participate in your own home a convenient time will be arranged for the researcher to visit you.

When you arrive at the University we will randomly assign you and your baby to one of two groups where you will be asked to complete a questionnaire and take part in a short thought task. Please ask us to explain this in more detail over the phone if you wish. We will then ask you to go into a separate room and play with your baby for five minutes, as you would if you were at home.

The researchers will not be in the room with you and your baby; instead there will be cameras filming the two of you at play. You will be told where the cameras are before the start of the experiment and all video footage will be kept confidentially in a locked room. You will then be asked to complete an observational task in which you will view a series of infant faces. Following this all participants will be debriefed individually, where you are free to ask any questions and where the researchers can answer your concerns.

After you have been debriefed the study is finished and you are free to go.

Are there any risks involved?

We expect that any risks, discomforts, or inconveniences will be minor and short lived,
but because the study is looking into the effects of thinking styles, your mood may drop. If this happens or at anytime you do feel too distressed or uncomfortable for yourself and your baby then you are free to withdraw without explanation.

The School of Psychology is composed of international and national experts in the treatment of mood. If you or your baby experience severe distress as a result of the study there will be professionals at hand to give emotional support. We will also be able to sign you to professional support services within your area.

With your help we will do everything possible to ensure that you and your baby are comfortable throughout the study. However if you do have any complaints or worries before, during or after the study please feel free to contact Michelle Tester-Jones on 07763857149 or by email: mct211@exeter.ac.uk

**What are the benefits participating?**

Your participation in this study with your baby will help us to better understand how maternal thinking styles affect mother-infant relationships. This knowledge will help develop and improve treatment options and support services available for mothers who may be struggling to develop quality relationships with their babies.

More specifically, your participation in this research may give you an invaluable insight into how you relate to your baby. You will have the opportunity during your debrief to discuss not only any aspects of the study that concern you but also those that may have interested you.

Your name will be entered into a prize draw where you will have a 1 in 15 chance of winning a spa treatment or Mothercare vouchers.

This study does not include any treatments or therapies.

**How will I know what I say will be confidential?**

Any information that is obtained in the study that can be identified with you or your baby will remain confidential. Confidentiality will be maintained by means of a code number to let Mrs. Tester-Jones know who you are. We will not use your name or your baby's name in any of the information we obtain from this study or in any of the research reports. When the study is finished, we will destroy the list that shows which code number goes with your name and your baby's name.

Information that can identify you individually will not be released to anyone outside the study. Mrs. Tester-Jones will however use the information collected in her PhD thesis and anonymised data from this study will be retained for use in a longitudinal study.

We may also use any information that we get from this study in any way we think is best for both publication and education. Any information we use for publication will not identify you individually.

We will provide a summary of the research findings as of Autumn 2013.

The recordings that we make of you and your baby during the interaction task will not
be viewed by anyone outside the study. Specifically they will only be viewed by Miss Tester, her research assistant and her PhD supervisor. The tapes will be destroyed after 5 years, in line with The American Psychological Association guidelines for conducting research. During that time they will be kept in a locked cabinet and will not be marked with any identifiable information about you or your baby.

If you have any complaints or concerns about any aspect of this study you can write to Cris Burgess, The Ethics Committee, School of Psychology. Washington Singer Laboratories, Perry Road, Exeter, EX4 4QG.

**When do I have to decide if I want to participate in the study?**

You can chose whether or not you and your baby want to be in this study, and if you would like to talk about it further then please contact Michelle Tester-Jones on 07763857149 or by email: mct211@exeter.ac.uk or complete and return the reply slip on the attached brochure.

If you volunteer to be in this study you may withdraw at any time without consequence of any kind. You may also refuse to answer any questions you do not want to answer.

If you do decide to take part in the study then you need to contact Michelle by phone or email in order to show your interest.

During this telephone conversation you will be able to inform Michelle as to whether you would like us to inform your GP of your participation in the study.

This study has been approved by the University of Exeter Ethics Committee and the South West 3 NHS Research Ethics Committee.

Thank you very much for taking the time to read this information sheet.

Date___________________
**CONSENT FORM**

Please initial box

<table>
<thead>
<tr>
<th></th>
<th>I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions</th>
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<tr>
<td>2</td>
<td>I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason</td>
</tr>
<tr>
<td>3</td>
<td>I agree to my interviews being audio/video-taped</td>
</tr>
<tr>
<td>4</td>
<td>I agree to take part in the above study</td>
</tr>
<tr>
<td>5</td>
<td>I would like to be sent information about the results of the research when they are available</td>
</tr>
<tr>
<td>6</td>
<td>I agree to my contact details being kept on the Mood Disorders Centre database so that I can be contacted to be invited to participate in future research</td>
</tr>
</tbody>
</table>

Name of Participant ___________________________ Date ___________________________ Signature ___________________________

Name of Person taking consent (If different from researcher) ___________________________ Date ___________________________ Signature ___________________________

Researcher ___________________________ Date ___________________________ Signature ___________________________