INVESTIGATING FACTORS AFFECTING INFANT CRY AND SLEEP ROUTINES FROM BIRTH TO TWELVE MONTHS

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Fiona Maria Kaley

ABSTRACT

The studies in this thesis explore both the individual differences and developmental trajectories in infant routines and bridge the disciplines of paediatric and developmental psychology. The different methodological approaches serve to highlight similarities in findings across the studies and clarify those methods which are best suited to this period of rapid development.

This collection of studies first addresses predictors of infant cry, feed and sleep routines generally, examining both the intrinsic and extrinsic factors in the first few weeks of life (Chapter 1). It highlights specifically the effects of maternal parity on infant sleep pattern and the possible differential responding of primiparous and multiparous mothers. As maternal mental health has typically been found to affect infant routines, maternal parity as a potential moderating factor in this relation is then investigated (Chapter 2). To examine the stability and change in routines infants are followed up in the only microgenetic study of its kind (Chapter 3). An online study detailed in Chapter 4 examines the effect of parity on maternal responses to infant crying and the final study (Chapter5) examines the effectiveness of a unique sling specifically designed to aid settling and soothing of distressed infants.

The studies highlight the potential variety of factors influencing infant routines and consequently the need for research in this field to control for confounding factors. It is becomes clear that research into infant routines ought to adopt longitudinal approaches to fully explore developmental changes during the first year postpartum.

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DECLARATION

I hereby declare that no part of this thesis has been submitted for a degree at this or any other university. This thesis has been composed by me and the research reported herein has been conducted by me.

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To my beautiful family for enduring periods of untidiness and ready-meals and without whose encouragement this thesis would not have reached completion.

To

Kevin, Grace and Matthew.

FACTORS AFFECTING INFANT CRY AND WAKE ROUTINES

1. Literature Review.

All parents are familiar with a newborn infant's night-time routine of waking, crying, and then returning to sleep once fed. Clearly, the infant behaviours of feeding, crying and sleeping are closely interrelated and one of the most intriguing and frustrating questions for new parents is why some infants cry, feed and wake more frequently than others. Some 47% of parents with five-month-old infants reported that their infant had a crying, sleeping or feeding problem, and of these between 46% and 52% reported that their infant had more than one of these problems (Wolke, Meyer, Ohrt & Riegel, 1995). Indeed, Lindberg (2000) and Lobo, *et al.* (2004) both reported that 'colic' or unexplained crying is the most frequent parental concern encountered by paediatric health care providers in a baby's first year.

A substantial body of research exists into infant cry and sleep routines yet there is little consistency of approach or focus of enquiry. For instance, some studies investigate the trajectory of problem crying or sleeping in clinical samples (Wolke *et al.*, 1995 and Wake *et al*., 2006) others investigate the trajectory or stability of typical infant cry or sleep routines over a specified period of development (e.g. Scher, 2004 and St James-Roberts, Conroy & Wilsher, 1998). While others explore the relation between sleep and cry routines (e.g. Schmid, Schreier, Meyer & Wolke, 2010; St James-Roberts & Hurry, 1997 and Wolke *et al*., 1995) yet others focus on identifying factors related to typical sleep and cry routines (e.g. Moore & Ucko, 1957; Morrell &

Steele, 2003 and Sadeh, Tikotzky & Scher 2010). It is the aim of this thesis to combine the last three approaches and study the trajectories of, relationships between, and factors affecting infant cry and sleep routines in infants from a typical population.

Although it is acknowledged that factors that might effect infant routines include those such as family context (such as level of emotional support and social class) environment (such as cot location, and ambient light and noise) and culture (such as demand/routine feeding and co-sleeping) (Bronfenbrenner, 1979), this thesis limits its scope to the more immediate putative causes of infant cry and sleep routines, namely infant and maternal characteristics. While infant and maternal factors have been more commonly researched, (eg. Moore & Ucko, 1957; Morrell & Steele, 2003 and Sadeh *et al*., 2010), in terms of their impact upon infant routines, than more distal causes, gaps and contradictions continue to exist in the literature.

Sadeh and Anders (1993) emphasise the importance of infant maturation, infant temperament and constitutional and health factors in infant routines,. Consequently, with regard to infant factors, this thesis examined the potential effects of infant birth order, sex, age and temperament. In addition this thesis examined the potential effects of different methods of infant feeding on infant routines not only because it is well recognised that mothers change feeding method in attempt to alleviate infant crying or to aid infant sleeping (Barr *et al*., 1991) but also because it is one of the major mother-child interactions during the first few months. However, as the focus of the thesis was on typically developing infants, very premature infants (38 weeks gestation and younger) and those with congenital health problems were not recruited to the study and so health factors have not been included in this thesis. With regard to maternal factors it has been suggested that the most influential characteristics are, maternal mental health, child-care experience and personality

(Sadeh & Anders, 1993). In order to limit the burden of participation on new mothers, maternal mental health and previous child care experience were the focus of interest for this thesis and only two maternal characteristics that have previously being identified as being related to maternal responsiveness were examined namely; attitude to child-rearing (e.g. Frodi, Bridges & Shonk, 1989) and perception of infant crying (e.g. Murray 1979).

The following literature review examines the research to date on infant sleep and cry routines. First the review discusses the research on the typical trajectory of infant sleep routines and then examines the evidence for infant and maternal characteristics that are thought to influence these routines. The review goes on to examine the research on the trajectory of infant cry routines and examines the evidence for specific infant and maternal factors that are thought to affect infant cry pattern. Finally, the effectiveness of interventions for excessive infant crying are discussed. The review concludes by discussing some of the limitations of the research and suggesting potential improvements and focus of study for future research.

1.1. Infant Sleep-Wake Pattern.

Parents are familiar with the rapidly changing sleep patterns of an infant's first year. Soon after birth infant sleep is made up of relatively short alternate sleep and wake episodes throughout the day and night, with the number of hours asleep gradually declining (Iglowstein, Jenni, Mollinari & Largo, 2003). By six weeks of age the infant is more awake during the day and more asleep at night, such that by 12 weeks of age a clear circadian pattern is established (Rivkees, 2004). Sleep continues to consolidate into longer night sleeping and fewer daytime naps (day-time sleep episodes) over the first two years (Weissbluth, 1995).

During this period of rapid change, sleep problems can become a source of concern to many parents (Mindell, 1993; Sadeh & Anders, 1993). There are two main concerns namely, difficulties in sleep initiation and, more commonly in infancy, excessive night waking, in particular those episodes of night waking during which the infant signals to the parent. Whilst infants wake around three times per night soon after birth they do not necessarily signal to their parents; consequently only the signallers are identified as wakeful by parents (Anders, Halpern & Hua, 1992). Anders *et al.* (1992) found that 90% of infants wake and signal during the first few weeks after birth, and that this reduces to 50% by three months. Indeed, whilst most children are able to self soothe and fall asleep alone by 12 months it has been estimated that between 20-30% still wake and signal at this age (Armstrong, Quinn & Dadds, 1994; Thunstrom, 1999). Moor and Ucko (1957) reported that 10% of babies never completely settled between the hours of 12am and 5am during the first 12 months. Moreover, both Moore and Ucko (1957) and Anders and Keener (1985) found that individual, night-time wakefulness remains relatively stable in the early months and increases in the second half of the first year. Whereas Sadeh, Mindell Luedtke and Wiegand (2009) reported that, in the birth to two month age range, the mean number of signalled wakes per night is 1.89 reducing by half to .93 signalled awakenings in the 12-17 month age range.

1.2. Factors Affecting Infant Sleep:

As outlined above, infant age is a significant factor in sleep routines. Soon after birth the longest duration of any one sleep episode is about four hours (Anders & Keener, 1985). By six months of age the infant is able to sustain longer sleep episodes of approximately six hours (Anders & Keener, 1985), but the duration of overall

infant sleep reduces largely due to a reduction in nap time (day-time sleep episodes) (Iglowstein *et al*., 2003). In a large scale prospective study Wake, Morton-Allen, Poulakis, Hiscock, Gallagher, and Oberklaid (2006) found that between two and 12 months of age the number of sleep episodes decreases whilst overall duration remains more or less stable at a mean of 13-14 hours. However, there appears to be considerable inter-individual variability in total sleep duration. For instance, in a cross-sectional study by Sadeh, *et al.* (2009), infants between three and 11 months of age were found to have daily sleep durations that ranged from nine to 16 hours per day.

Research also indicates that method of infant feeding is a factor in infant sleep pattern; with breast-fed infants not only waking more frequently at night than bottle-fed infants, but also waking for longer duration. For instance Wolke *et al*. (1995) found that at five months partially and fully breast-fed infants had significantly higher wake frequencies than formula-fed infants. Moreover, 20% of breast-fed infants woke for long periods versus 7.1% of formula-fed infants. Further support comes from a large scale cross-sectional internet study of infants from birth to 36 months found that night waking was predicted by greater parental involvement in settling the infant and in particular breast-feeding (Sadeh *et al*., 2009). However, Goodlin-Jones, Burnham, Gaylor and Anders (2001) found that, in a cross-sectional sample of 80 infants aged three, six, nine and 12 months, whilst infant signalled waking was associated with breast feeding at three months, the association was absent between six and 12 months, suggesting that the relation is of a short-term nature. Whereas Lee (2000) in a cross-sectional diary study of infants between 11 days and 17 weeks found that whilst breast-fed infants had shorter sleep episodes than formula-fed infants they had longer

total sleep duration within each 24 hour period. However the comparability of studies is compromised by the difference in ages of infant samples.

Whether male and female infants differ in their sleep patterns has also been a matter of significant debate. Schmid, Schreier Meyer and Wolke (2010) and Thunstrom (1999) found that, significantly more boys than girls were found to have sleep problems (parentally defined). Similarly, Anders *et al*. (1992) found that in a sample of 21 infants all seven of the problem sleepers (parentally defined) were male. However, no effect of sex of child on either nap frequency or duration was found by Weissbluth (1995) and in a large-scale, longitudinal study, following infants at 1, 6 and 12 months of age, Tikotzky and Sadeh (2009) found no significant sex effect on a number of sleep measures including total sleep duration, night waking and nap duration.

Birth-order (or maternal parity) is another putative factor affecting infant sleep. Fish and Stifter (1993) found that multiparous mothers (mothers of more than one child) of five-month infants reported greater confidence and effectiveness as a mother than did primiparous mothers (mothers of one child). They suggest that parity moderates the relation between the mothers' personality and actual parenting attitudes and behaviours, which in turn affects infant routines. de Weerth and Buitelaar (2007) suggest that as first-born infants are more likely to experience birth complications it is possible that delivery complications affect the parenting style of the mother. Nevertheless, no effect of birth order was found by Weissbluth (1995) in children from 6 months to 7 years on nap frequency or nap duration. Similarly, Thunstrom (1999) found no effect of birth-order on sleep in infants 6 to 18 months of age. However, others have argued that the family systems that a first-born experiences are different from the family systems that are in place for subsequent infants therefore,

some research, recognising the potential effects that birth-order might have, has specifically selected first-time mothers only (e.g. Wake *et al.,* 2006), but there is little empirical evidence into birth-order effects on infant sleep.

Temperament has been defined as 'A variety of constitutionally based characteristics' (Crockenberg and Acredolo. (1983, p 61) and a number of studies have reported evidence of differences in temperament during the neonatal period (Brazelton, 1977; Freedman, 1974). Indeed, a substantial literature exists on the effect of infant temperament, in particular 'easy' versus 'difficult' temperament on sleep but findings have once again been conflicting. Weissbluth (1984) suggests that children with easy (more positive) temperaments have longer total sleep durations than those with difficult (more negative) temperaments. Similarly, Touchette, Petit, Paquet, Boivin, Japel and Tremblay (2005) found that a 'difficult' temperament, defined as irritable and fussy, to be a significant and independent risk factor for poor sleep consolidation between 5 and 29 months and Halpern Anders, Garcia Coll and Hua (1994) found infant temperament at both three weeks and three months was related to sleep-wake indices. In contrast, Morrell and Steele's (2003) findings indicated that there is no direct link between an infant's temperament and sleep for infants between 14 and 16 months, and in a study by DeLeon and Karraker (2007), temperament ratings were generally unrelated to infant sleep and wake behaviours. However, as Touchette, Petit, Tremblay and Montplaisir (2009) have argued, the relation between infant sleep and infant temperament is probably complex involving both maternal responses to infant temperament and infant sleeping.

Infant routines such as crying and sleep-wake pattern are often assumed to reflect enduring characteristics of the child (Thomas & Chess, 1977). For instance Zuckerman, Stevenson & Bailey (1987) in a longitudinal study of 308 infants found

that those with sleep problems (defined in terms of duration of time awake per night) at eight months were more likely to have sleep problems at three years (41%) and that such persistent sleep problems (i.e., at 8 months and 3 years) were associated with behaviour problems. However, Hayes, McCoy, Fukumizu, Wellman and DiPietro (2011) investigated the relation between infant temperament and sleep-wake routines using an infant temperament questionnaire. Their findings suggest that whilst both infant waking and temperament are relatively stable, they are also independent of each other. Moreover, not all studies have found continuity in wake pattern. For example, in their large scale epidemiological study in England, Moore and Ucko (1957) reported that of those infants who had settled at 3 months 50% began to exhibit night waking at 12 months. Similarly, in a sample of 'at risk' infants (i.e. infants admitted to hospital within ten days of birth) Schmid, *et al.* (2010) found short-term but not long-term stability in infant sleep/wake problems. Lam, Hiscock and Wake (2003) found that, of those with sleep/wake problems (defined by parental category rating) at eight months, less than one third had problems at three to four years of age. It seems that the controversy over the relation between infant temperament and sleep routine might, in part, be due to a lack of agreement in the selection of temperament dimensions the different ways in which temperament is measured and variation in defining 'problem' sleeping.

With regard to maternal factors affecting infant sleep routines, a number of studies have focussed on maternal characteristics such as maternal cognitions (mothers' thoughts about their own efficacy as a parent or thoughts about their infant's wellbeing), mental health and concomitant maternal behaviours (e.g.: Bayer, Hiscock & Hampton *et al*., 2007; Burnham, Goodwin-Jones, Gaylor & Anders, 2002; Sadeh, Tikotzky & Scher, 2010; Tikotzky & Sadeh, 2009). Morrell (1999) reported

that sleep problems in infants, aged 13 to 16 months, were significantly related to maternal cognitions concerning difficulties in limit setting, (i.e. difficulty in resisting the infants demands) increased doubts about parenting competence, and increased anger. Similarly, Sadeh, Flint-Oftir, Tirosh and Tikotzky (2007) found that parents of sleep disturbed infants expressed more concern with limit setting than did control parents who had no infant sleep complaints.

Closely related to the role of maternal cognitions is that of maternal mental health. Sadeh and Anders (1993) argued that parental personality and psychopathology are amongst the most important maternal characteristics affecting infant sleep. For instance, maternal depression and anxiety have been found to be associated with sleep problems in eight-month old infants, and the prospective study indicated that the negative maternal feelings were not a consequence of the infants' sleep disturbance (Zuckerman, *et al*., 1987). Pauli-Pott, Mertesacker, Bade, Bauer and Beckmann (2000) found that negative infant emotionality only affected mother-infant interactions when maternal depression was also present. Alternatively, Hiscock and Wake (2001) and Wake *et al.* (2006) found that persistent poor infant sleep is a risk factor for maternal well-being and contributes to maternal depression and parenting stress. Indeed, in a cross-sectional study by Bayer Hiscock, Hampton and Wake (2007) infant sleep problems (parentally defined) between three and six months of age were reported by 34% of mothers and were found to be associated with maternal fatigue and depression. They concluded that prevention of infant sleep problems is important in improving maternal health. Much of the research investigating the relation between maternal characteristics and infant sleep has been undertaken with infants beyond six months of age. Fewer studies have focussed on sleep problems in the first few weeks postpartum. One such study by Dennis and Ross (2005) found that

depressed mothers, of infants between four and eight weeks postpartum, reported more infant sleep difficulties in the first few weeks than non-depressed mothers. However the direction of the cause and effect relation between maternal mental health and infant routines is often difficult to establish.

The transactional nature of the relation between infant sleep and parental responses has been emphasised by Sadeh and Anders (1993) and Sadeh, *et al*. (2010). In a transactional model of infant sleep they propose that not only do maternal emotions and psychopathology contribute to infant sleep problems but the reverse is also true. Whilst there are various mechanisms by which maternal mood might affect infant sleep regulation, a complementary pathway exists whereby an infant's poor sleep is a risk factor for maternal well-being. According to the model these factors, in turn, affect the mother-child relationship and concomitant parenting routines, ultimately affecting the sleep pattern of the infant. For example, Morrell and Steele (2003) found that a fussy temperament together with maternal cognitions about limit setting were the most relevant factors associated with sleep problems in 14-16 month-old infants. Pauli-Pott, *et al*. (2000), found that negative infant temperament only affected mother-infant interactions when maternal depression was also present. Whereas Fish and Stifter (1993) suggest that parity moderates the relation between the mothers' personality and actual parenting attitudes and behaviours.

1.3. Infant Cry Patterns:

Cry patterns in early infancy have two main features, first, a developmental peak characterized by an increase in crying from birth to 6 weeks of age, followed by a decline until 12 weeks and second, a tendency for crying episodes to cluster in the

evening during the first three months postpartum (Brazelton, 1962; Hunziker & Barr, 1986; St James-Roberts & Halil, 1991).

In a review of treatments for excessive crying, Garrison and Christakis (2000) report that the incidence of excessive crying lies somewhere between 16-26%. In their review of occurrence rates Lucassen *et al.* (2001) found rates of between 5 and 40%. The studies that Lucassen *et al.* considered to be the most robust in design obtained occurrence rates of 5% (Canivet, Hagander, Jakobsson, & Lanke, 1996) and 19% (Høgdal, Vestermark & Birch, 1991). In practice, according to Lucas and St James-Roberts (1998), 16% of families with a child younger than 3 months approach a health visitor or GP for advice or treatment for excessive infant crying. Furthermore, Lindberg (2000) reported that excessive unexplained crying are the most frequent parental concerns encountered by paediatric health care providers in a baby's first year. Indeed, Morris, St James-Roberts, Sleep and Gillham (2001) estimated that the annual financial cost, to the NHS, of infant crying and sleep problems in the first 12 weeks, to be around £65 million.

1.4. Factors Affecting Infant Cry Patterns:

As with infant sleep routine age is a well established factor in typical infant cry pattern. Cry duration reaches a peak at six weeks with a mean of 165 minutes of crying per day declining to a mean of 60 minutes per day at 12 weeks (Brazelton, 1962). Support for this early peak and plateau in infant crying comes from the work of St James-Roberts and Halil (1991) who, in a longitudinal study over the infants' first 12 months, found that age was the most influential factor in infant crying and this seems to be the case irrespective of parenting practices (Alvarez & St James-Roberts, 1996).

Method of feeding has also been explored as a potential factor in infant cry routines. Wolke, *et al.,* (1995) found that while five- month breast-fed infants cry more often, they do not cry for longer than formula-fed infants. Whereas Lucas and St James Roberts (1998) found that six-week-old, breast-fed infants demonstrated more prolonged crying than formula-fed infants. A randomised controlled trial, from birth to six months, of 302 breastfeeding mother-baby pairs that compared different breastfeeding techniques found that functional lactose overload (when breast feeds do not contain enough fat, there is rapid milk transit through the intestine, causing undigested lactose to ferment in the colon) was significantly associated with infant crying (Evans, Evans & Simmer, 1995). As yet the effects of feeding on infant crying remain inconclusive, in part due to differences in sample ages as in the studies above.

There is some indication that boys cry more than girls (Lundqvist & Sabel, 2000) and that girls are significantly less likely than boys to have a cry problem at five months of age (Wolke, Schmid, Schreier & Meyer, 2009). However, in a large scale study of a community sample (selected consecutively from birth registers) of 400 infants across the infants' first postnatal year, St James Roberts and Halil (1991) found no difference in the amount or pattern of crying between males and females. Once again, a definitive answer is difficult to reach as the age of infants varies from 48 hours to 12 months across different studies.

With regard to birth-order St James Roberts and Halil (1991) investigated infant crying across four age ranges in the first postnatal year, with both community and clinical populations. In their community sample of infants, birth order did not contribute to the amount or pattern of crying; while in the clinical sample (comprising of 68 dyads), parents who had sought medical help for their infants' crying were more likely to be first time parents than parents with more than one child.

In contrast to birth-order, research into the effect of infant temperament on crying has been extensive. Indeed the extent to which infants cry has often been accounted for in terms of their temperament. However, there has been much debate as to which of the temperament dimensions from temperament questionnaires are most relevant to crying behaviour. For instance, Carey (1972) argued that low sensory threshold is the only dimension related to infant crying; while Lehtonen, Korhonen and Korvenranta (1994) have suggested that more intense reaction, negative affect, less persistence and greater distractibility are the most important dimensions characterising crying infants.

As with infant sleep-wake routines the stability of a cry problem is sometimes interpreted as indicative of the infant's temperament (Thomas and Chess, 1977) but Wake *et al*. (2006) argue that while cry-fuss problems are prevalent at every age between two and 24 months, they are transient and not indicative of the infant's temperament. Support for the instability of infant cry routines also comes from deWeerth, van Geert and Hoijtink (1999). In a longitudinal study of five infants they found intra-individual variability in crying between birth and five months and between five and ten months, with crying only becoming more stable between 10 and 15 months. Once again not only is the lack of an agreed approach to defining and measuring infant temperament a potential contributing factor in the lack of consistency in research findings, but so too is the variety in infant sample ages.

Maternal characteristics have also been explored as possible factors affecting infant cry routines. For example excessive crying has been attributed to inadequate parenting, such as over anxious parenting (Boukydis, 1985, as cited in Lester, Boukydis, Garcia-Coll, Hole and Peuker, 1992), or parents who fail to respond appropriately to the needs of their infant (Dihigo, 1998; Taubman, 1984). However

Helseth and Begnum (2002) argue that whilst mothers whose infants cry excessively often feel less competent and have higher levels of stress and fatigue, this is potentially a consequence of excessive crying and not the primary cause. They suggest that whilst parents under stress might alter their responses to their infant and exacerbate the problem, there is no evidence that parental responsiveness is the original cause of excessive crying.

Nevertheless, maternal ability to perceive and process differences in infant crying has been found to vary substantively (Donovan, Leavitt and Walsh, 1997; Lester, Boukydis, Garcia-Coll, Hole & Peuker, 1992). Zeifman (2003) explored how individual personality differences might be associated with different responses to infant distress. Zeifman recruited 188 men and women with at least one child, who was less than 18 years of age. The results showed that relatively high levels of empathy and extraversion and low levels of conscientiousness were associated with more sympathetic responses and that infant-centred attitudes were associated with greater sympathy, shorter response latencies and a greater tendency to perceive the cry as urgent.

As might be expected some maternal characteristics have been shown to interact with infant characteristics in the effect they have on infant crying. For instance, Frodi, Lamb and Wille (1981) recruited a sample of 32 mothers with infants aged 7 months and older (16 mothers of premature infants and 16 mothers of full-term infants). They found that while all mothers showed increased arousal (heart-rate) to premature infant cries, mothers of premature infants themselves showed especially high levels of arousal. Similarly, Zeskind (1980) found that parents responded differently to high risk cries (i.e. cries of infants with high prenatal and perinatal complications) and low risk cries (i.e. cries of infants with few prenatal and perinatal

complications); with high risk cries eliciting more tender and immediately effective responses and more consistency of response than low risk cries. However, this differential responding to high and low risk cries was not found amongst non-parents, indicating that not only do variations in infants' cries elicit different responses but that parental experience also seems to affect responses. Boukydis and Burgess (1982) investigated physiological responses (skin potential response) in mothers and fathers, with infants between 8 and 24 weeks old, to infant cries. The sample of 24 primiparous, and 24 multiparous parents and 24 non-parents were exposed to 12 cry samples of infants aged between three and five months. They found a main effect for type of cry and an interaction effect of cry type and parental experience on physiological arousal measures. Primiparous parents showed highest arousal levels to average infant cries. In contrast, multiparous parents showed higher arousal to the difficult cries and lowest to the easiest cries. Boukydis and Burgess suggest that previous experience with infant cries explains the lower arousal of multiparous parents to average cries than primiparous parents.

Similarly, Stallings, Fleming, Corter, Worthman and Steiner (2001) examined affective, hormonal and heart rate differences in 27 new mothers, of infants between 24 and 48 hours postpartum, in response to infant cries. Multiparous mothers expressed more sympathy, as measured by an Emotional Response Score (ERS), to pain cry than to a hunger cry whereas primiparous mothers responded with similar levels of sympathy to both cry types, indicating that primiparous mothers were less able to discriminate infant cries. Furthermore higher ER scores were reflected in physiological arousal of the mothers, measured in terms of cortisol levels and heart rates. Although it has been suggested that that infant cries are not distinguishable into pain and hunger cries during the first few weeks postpartum.

Such differences in physiological arousal between multiparous and primiparous mothers would suggest that there might also be differences in their caretaking practices in response to infant cries. Donate-Bartfield and Passman (1985) investigated parental latency of response in a paradigm where participants were led to believe that a heard cry was their own child's cry. The sample consisted of 16 primiparous parents and 16 multiparous parents of infants between 10 and 11 months of age. Primiparous parents gave more frequent and rapid attention to what they believed to be their infant's cry from an adjacent room, than multiparous parents but no difference was found in aversiveness ratings between primiparous and multiparous parents. In Chapter four, an online study explores the potential effect of parity on maternal responsiveness to infant crying and examines whether differences in attitude to child rearing or perception of infant crying might contribute to any parity effect.

In addition to the research that has been carried out on typical infant crying routines, a large body of work exists exploring causes of excessive infant crying (sometimes referred to as 'colic'). The putative proximal causes of excessive crying can be grouped into four: physiological (e.g. immature gastrointestinal or autonomic nervous system function), environmental (e.g. parent responsiveness), multiple causes and finally, no specific cause, with excessive crying simply at the extreme of the normal distribution. To add to this complexity several distal causes have been proposed, such as socio-economic status. As yet there is no conclusive evidence to support one or more of these potential causes, consequently a wide range of interventions has been explored including natural remedies, dietary and pharmacological interventions and behavioural/psychological interventions. Whilst some interventions are effective for some infants some of the time, as yet, there is no one reliably effective treatment. Clearly the most readily available intervention for

parents is some form of behavioural intervention. Indeed Ciftci and Arikan (2007) studied the treatment methods adopted by Turkish parents for excessive crying and found that 100% of parents used some form of behavioural intervention, such as rocking and carrying. Hunziker and Barr (1986) assessed the effectiveness of supplementary carrying of infants in minimising crying. They found that there was no significant difference between the groups in the frequency of infant cry bouts but that there was a 43% reduction in cry duration at the 6 week period. However, in a follow–up study (Barr *et al.,* 1991) this improvement in cry duration was not evident for excessively crying infants. If, however, excessive crying is multifactorial then it might be argued that a number of effective interventions ought to be expected. The final study (Chapter five) examines the effectiveness of a 'settle-sling' which facilitates a number of behavioural interventions, in soothing infant crying.

1.5. *Research Limitations*

Four main limitations of the research to date have been identified. First, the cross-sectional approach adopted by most studies neglects to take into account intra-individual variation in infant routines across time (Alvarez & St James-Roberts, 1996; Goodlin-Jones *et al*., 2001; Sadeh *et al.,* 2009). Selecting infants from different age ranges might obscure potential variability in the developmental trajectory of infant routines and contribute to inconsistencies in findings. In the microgenetic study the developmental trajectory of infant routines was followed longitudinally from six months to 13 months with data collected every fifth week.

Second and related to the first issue, different studies recruit infants from different age ranges, with some studies including a relatively wide age range; this makes comparisons across studies difficult (Anders *et al*., 1992; Wolke *et al*., 2009).

To avoid difficulties arising from selecting infants of widely differing ages, during this time of rapid development, the studies in this thesis focussed on a narrower age range making findings relevant to a specific point in development. That is, study one (Chapter Two) examined infant routines between four and ten weeks postpartum,. Chapter Three collected data when infants were between seven and 12 weeks, and the microgentic study collected infant data longitudinally from 6 months to 13 months.

The third limitation is the neglect of many studies to investigate the effect of, or control for, potentially confounding factors such as sex of the infant, and birth-order, while others assume effects with little empirical evidence (Goodlin-Jones *et al*., 2001; Wake *et al*., 2006; Zuckerman, 1987). Inconsistencies in sample profiles therefore, might be responsible for some of the inconsistencies in previous findings.

The fourth and final limitation concerns intervention studies and their tendency to focus on investigating isolated behavioural interventions to ease infant crying (Hunziker & Barr, 1986; Peláez-Nogueras *et al*., 1996), when such behaviours rarely occur in isolation (e.g. stroking and eye contact) . Chapter Seven details anlaysis of the effectiveness of a sling which combined several behavioural interventions for infant crying.

1.6. Summary.

A large number of studies investigating factors that affect infant sleep and cry routines have been carried out in an attempt to determine the causes of inter-individual variability. Whilst earlier research focussed on problematic crying and sleeping more recent research has looked at normative samples, albeit mainly cross-sectional in nature. During this period of rapid development there is clearly a need for more studies to adopt a longitudinal approach, following closely the developmental

changes in sleep and cry routines. Furthermore as these routines are closely related to each other in early infancy more research is needed to explore the nature of this relation, and how maternal responses might affect these. As yet, there are few generally agreed extrinsic or intrinsic factors that affect infant routines, some such as maternal parity are assumed to exist with little empirical evidence. Differences of opinion in the literature, in part, seem to be due to differences in sample ages, in operational definitions such as in 'problem' waking or crying and in methodological approaches such as cross-sectional versus longitudinal approaches. Clearer parameters need to be established to facilitate a more coherent approach. The following studies aim to address these issues and to improve our understanding of infant cry and sleep routines.

2. Thesis Structure.

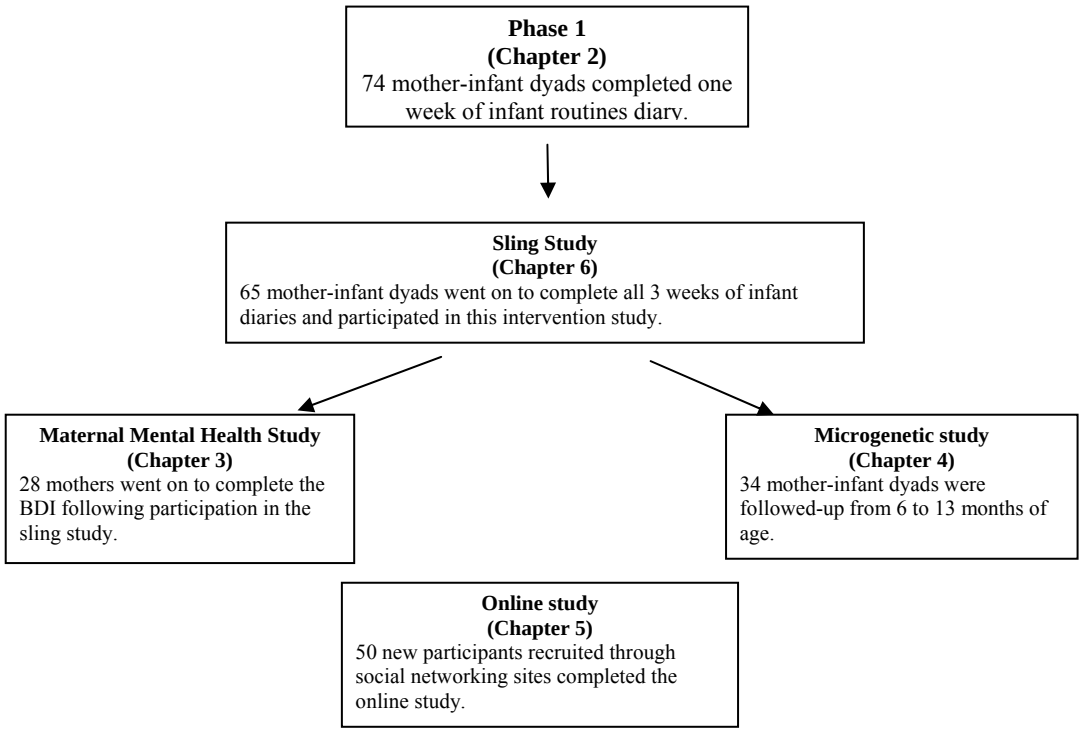

Figure 1.1. Diagram illustrating the order in which studies were conducted and the order in which mothers participated in the five studies.

The thesis details five empirical studies into various aspects of infant cry and sleep routines. The first of these (Chapter Two) examines a number of proximal infant characteristics that might be associated with infant routines. This cross-sectional study recruited a sample of 79 infant – parent dyads when infants were between four and nine weeks of age, when crying is at its peak and sleep routines have not yet become established. Participants recorded cry, sleep and feeding routines over a period of one week in an attempt to identify those factors in a normative sample that might affect variation in infant routines. As discussed in the literature review, the specific variables of interest were infant temperament, feeding method, birth order, age and sex of infant. Due to lack of empirical evidence for some of the variables (such as birt-order)

and due to controversial findings in others stepwise regression analyses were carried out to examine which factors might be predictive of infant routines.

As discussed in the literature review one particular extrinsic factor which has been associated with infant sleep pattern is that of maternal mental health. To further explore the findings from the first study, Chapter Three details a study examining the potential relation between parity and infant temperament with that of maternal mental health and how, together, these might affect infant sleep. Twenty-eight participants from phase one took part in this second phase of The Infant Behaviour Study. Two-way ANOVAs were carried out to examine possible main and interaction effects of the three variables (infant parity, and temperament and maternal mental health) on infant sleep duration.

In the microgenetic study (Chapter Four) 34 infants were followed-up from the original 79 in phase one, to examine sleep, feed and cry routines longitudinally from 6 to 13 months of age. Data were collected on infant routines every fifth week so as to follow closely the developmental trajectory of these routines for the sample and to look at individual variation. The potential effects of maternal parity, sex of infant and feeding method on infant routines beyond the first three months were examined as was whether these later routines could be predicted from the infants' routines in early infancy. A detailed descriptive analysis of the data was carried out to look at group and individual trajectories followed by correlational and regression analyses to examine associations between the variables of interest.

To examine further the findings from the first study the focus of Chapter Five, was the potential effects of maternal parity, attitude to child rearing and perception of infant cry on maternal response latency to infant cry stimuli. Fifty mothers, with infants less than 12 months of age, participated by listening to infant cry stimuli and

completing questionnaires online. Differences between primiparous and multiparous mothers were explored using *t*-tests and potential predictor variables were explored using linear regression analyses.

The final, experimental, study (Chapter Six) investigated the effectiveness of a newly developed Settle-sling (A novel sleep aid for infants which holds the infant close to the mother but permits eye contact) in soothing crying infants. Sixty-five participants were allocated to one of three conditions namely, Settle-Sling, no-sling, or commercially available sling and recorded infant cry and sleep routines in a diary. ANOVAs were used to examine the effect of condition on infant crying.

The thesis ends by reviewing the main findings from each of the studies and discussing how they contribute to our current understanding of infant cry and sleep routines. Ways for extending the findings detailed in the studies and ways to improve coherence in future studies are suggested (Chapter Seven).

CHAPTER TWO

INVESTIGATING THE BIOGRAPHIC, SOCIAL AND TEMPERAMENTAL CORRELATES OF YOUNG INFANTS' SLEEPING, CRYING AND FEEDING ROUTINES

Abstract.

The aim of this study was to investigate the effect of intrinsic and extrinsic factors on feeding, sleeping and crying routines in infants aged between 4 and 10 weeks. Seventy-nine child-parent dyads from the North East of England participated in this cross-sectional study. Data on infant feeding, sleeping and crying routines were collected by parental diaries (Appendix 1.1) for a minimum of three days over the period of a week. Biographic data including age, birth-order, sex and feeding method were collected by questionnaire (Appendix 1.5) and temperament was assessed using the Early Infancy Temperament Questionnaire(Medoff-Cooper, Carey & McDevitt, 1993) (Appendix 1.3). First-born infants were found to have longer feed duration and shorter nap and total sleep durations than later-born infants. In addition, more those infants rated as more temperamentally easy tended to have longer total sleep duration than those rated as temperamentally more difficult. Breast-feeding and sex were related to more frequent waking and breast-feeding and boys associated with more frequent feeding episodes. Age was associated with cry frequency. None of the independent variables used in the current analyses were related to infant cry duration. The results support previous findings but add to the current literature by showing that parity also has an effect on infant routines.

1. Introduction.

Clearly the infant behaviours of feeding, crying and sleeping are closely interrelated and St James Roberts (1989) is amongst those who suggest that common sleeping and crying problems are a result of neuro-developmental reorganisation, whilst others have placed emphasis on the importance of extrinsic factors (parental characteristics and behaviours), as well as intrinsic factors (infant constitutional and temperamental characteristics), when considering individual differences in infants' routines (e.g. DeLeon & Karraker, 2007). Thomas, Chess and Birch (1968) refer to an interplay between the characteristics of the organism and environmental stresses and Sadeh, Tikotzky and Scher (2009) propose a hypothetical transactional model between culture, family and individual characteristics affecting infant behaviour, and infant behaviour, in turn, affecting the environment, such as parental responses. Whilst extensive research exists on infant correlates for problems in crying, sleeping and feeding in clinical populations, fewer studies concurrently investigate cry, feed and sleep behaviours in a normative population, particularly in the first few postnatal weeks. The current study aimed to rectify this by investigating the inter-relations in a normative population of young infants' crying, sleeping and feeding patterns, in the light of possible constitutional (age, sex, birth order), and temperamental factors. In addition breast feeding was investigated as a potential predictor variable as the benefits of breast-feeding are internationally recognised (WHO) yet breast-feeding is often ceased in an attempt to aid infant sleep or ease infant crying (Barr *et al.,* 1991).

1.1 *Factors Affecting Infant Cry Patterns*

1.1.1. *Age*. As mentioned in the literature review (section 1.2) cry duration typically increases during an infant's first postnatal weeks, reaching a peak at around four to six weeks, thereafter declining to baseline around three to four months of age (Brazelton, 1962; St James Roberts & Halil, 1991). It was the aim of this study to examine the effect of infant age on cry patterns relative to other infant characteristics.

1.1.2. *Feeding method*. In an attempt to alleviate excessive infant crying, parents often change their feeding method, in particular from breast to formula feeding, sometimes but not always, under medical advice (Barr *et al.,* 1991). Indeed, Wolke, *et al.* (1995) and Barr, Kramer, Pless, Boisjoly and Leduc (1989) suggest that while breast-fed infants cry more often, they do not cry for longer, than formula-fed infants. In contrast Lucas and St James Roberts (1998) found that, six-week-old, breast-fed infants did demonstrate more prolonged crying than formula-fed infants. However, because infant age ranges in the different studies has varied greatly firm conclusions have not been reached.

1.1.3. *Sex*. Whether an infant's sex is related to his/her crying is also controversial. With a sample of infants recruited 48-72 hours post partum Lundqvist and Sabel (2000) found that boys cry more frequently or are more difficult to settle than girls. Similarly, Wolke *et al.* (2009) found that at five months of age girls are significantly less likely than boys to have a cry problem at five months of age. However, St James Roberts and Halil (1991) found no difference in the amount or pattern of crying between males and females. Once again the age of infants varies across studies from 48 hours to 12 months.

1.1.4. *Birth-order*. Findings of the effect of birth order on an infant's cry pattern have been limited. St James Roberts and Halil (1991) found no effect of birth-order in their community sample of infants.

1.1.5. *Temperament*. The extent to which infants' cry has often been explained in terms of their temperament. However, as highlighted in the literature review (section 1.2) there is little agreement as to which of the temperament dimensions are most relevant to crying behaviour. Barr & Gunnar (2000) argue that as there has been little agreement, the relation between excessive crying and any particular temperament dimension cannot be robust. It is possible that discrete dimensions can't be reliably identified, therefore for the purposes of the current study, an overall measure of infant temperament, that is, the sum of dimensions was adopted, as arguably this might reflect overall infant affect more accurately.

1.2 *Factors Affecting Infant Sleep Patterns.*

1.2.1. *Age.* Age clearly affects infants' sleep patterns. Infants who are full term at birth sleep around 16 to 18 hours per day and this gradually declines to 13 to 14 hours per day by six months of age. Nevertheless, by six weeks of age the infant is more awake during the day and more asleep at night and by around 12 weeks a circadian pattern is established (Rivkees, 2004). Consequently the current study investigates the role of additional factors alongside age, which might be related to infant sleep patterns.

1.2.2. *Feeding method*. As discussed in the literature review (section 1.1) there is some indication that method of infant feeding is a factor in infant sleep pattern. (Lucas & St James Roberts, 1998; Wolke, Meyer, Ohrt & Riegel, 1995; Wolke, Sohne, Riegel, Ohrt & Osterlund, 1998). Indeed, Wolke *et al.* (1998) found that breast

feeding was the only independent predictor of night waking and it was suggested that the relation between frequency and duration of feeds to night waking is accounted for largely by feed type. However, there is some indication that, whilst breast-fed infants have shorter sleep episodes they actually have longer total sleep duration within each 24 hour period (Lee, 2000).

1.2.3. *Sex*. Controversy surrounds the existence of sex differences in infant sleep patterns. Thunstrom (1999) found significantly more boys than girls were considered to have a sleep problem but no effect of sex has been found by Weissbluth (1995) and Tikotzky and Sadeh (2009).

1.2.4. *Birth-order*. Birth-order is another potential factor affecting infant sleep. It has been argued that the family systems that a first-born experiences are different from the family systems that are in place for subsequent infants. As a result, some research investigating infant behaviour has recognised the potential effects that birth-order might have, and therefore, only selected first-time mothers. Fish and Stifter (1993) argued that as a result many studies have failed to empirically address the issue and consequently, there is little research into birth-order effects on infant sleep. However, Sadeh and Anders (1993) proposed that whilst sleep-wake regulation is mediated by the parent-infant relationship, it is most influenced by the intrinsic context, particularly that of temperament and bio/medical factors. It might be argued, therefore, that not only is birth-order an intrinsic context for the infant but also contributes to the family context.

1.2.5. *Temperament*. While a substantial literature exists on the effect of temperament on sleep, findings have been conflicting. Weissbluth (1984) found that infants with more positive affect tended to sleep longer than those with negative affect and Touchette *et al.* (2005) and Touchette *et al.* (2009) found that a negative affect

was a significant and independent risk factor for poor sleep consolidation. In contrast, Morrell and Steele (2003) and DeLeon and Karraker (2007) found no relation between an infant's temperament and sleep.

1.3 *Factors Affecting Infant Feeding Patterns.*

1.3.1. *Age*. During the first three months after birth, as the infant settles into a routine, frequency of infant feeding decreases with age. De Carvalho, Robertson, Merkatz and Klaus (1982) reported that, for breast-fed infants, feed frequency decreased from an average 9.8 times per 24 hours (+/- 2.5) during the first two weeks postpartum to 7.2 times per 24 hours (+/- 1.3) at four weeks. It was the aim of the current study to explore age effects in relation to other infant characteristics.

1.3.2 *Feeding method*. It is well documented that infant feeding is more frequent for those who are breast-fed than those fed formula milk (Barr *et al.,* 1989 and Wolke *et al.,* 1998). Indeed, Wolke *et al*. (1995) found that at five months, breast-fed infants feed a mean of 5.3 times per day versus 4.4 for formula-fed infants, and that fully breast-fed infants feed for a longer duration. This study examined the relation between feed type and feed routines before the age of weaning.

1.3.3. *Birth-order and Sex*. In contrast there has been little research investigating whether either birth order or sex is associated with feeding frequency or feeding duration. Wolke *et al*. (2009) found no sex differences in feeding problems. With regard to birth-order a study by Bates, Freeland & Lounsbury (1979) found that primiparous mothers feed their infants more frequently and for longer than multiparous mothers. This study aimed to correct the lack of research in this area.

1.3.4. *Temperament*. As with birth-order and sex, relatively little research has considered the relation between temperament and feeding routines. A recent study by

Galler, Harrison, Ramsey, Butler and Forde (2004) suggests that a negative temperament can make the infant's hunger signals more difficult to interpret by the mother and lead to feeding problems from early infancy. Consequently the potential relation between temperament and feed routine were explored further in this study.

1.4 *Summary.*

Extensive work has been carried out on infants with problems in crying, feeding and sleeping. However, as infant routines are a matter of concern to most parents of newborn infants, the current study aimed to extend previous work by examining concurrently some pertinent intrinsic and extrinsic factors which might be related to behaviours in a normative sample of young infants. Specifically, this study aimed to examine the relation between feeding method, sex, birth-order, temperament and age in a community sample of participants aged four to nine weeks on crying, sleeping and feeding patterns. The age range of the sample was specifically chosen as this is the time when crying is at its peak and sleep wake patterns have yet to be fully established.

Our main aim was to further examine those factors which are related to infant sleep, feed and cry patterns in a normative population and which, therefore, need to be controlled for in early infancy research to achieve a clearer picture of the relative effects of these factors. For some factors included in the study, it was not possible to make a clear prediction as either the previous findings were contradictory, and no general consensus had been reached (such as in the effect of temperament on routines), or little work had investigated the factor (such as birth-order). However, based on previous research we expected that feeding type would be related to wake, cry and feed frequency but not necessarily duration. Sex would not be related to

sleeping, crying or feeding routines, and that birth order would be related to feeding frequency and duration. Finally it was expected that, consistent with well-established findings, an infant's age would be associated with crying and sleeping patterns.

2. Method

2.1. *Ethics*.

Ethical approval was granted in December 2008 by Durham University Psychology Department Ethics Committee. All participants were made aware that they were free to withdraw at any time and that they could choose not to answer all questions on questionnaires. Participants were informed that individuals would not be identifiable in any subsequent reports and were allocated an anonymous identification number to be used on all diaries and questionnaires. The record of participants name and number was stored separately and all data were stored in accordance with the Data Protection Act 1998.

2.2. *Design.*

A correlational design was adopted. Mothers were asked to provide biographic details, fill out a temperament questionnaire and keep a record of their infants' sleeping, crying and feeding routines over the period of one week, for a minimum of three days.

2.3. *Participants.*

Seventy-four mother-infant dyads were recruited to the study. At the time of recruitment mean infant age was 47 days (SD = 12). All mothers were full-time carers

of their infant. 74% were recruited from children's centres in two local authority areas in the North East of England, 13% by word of mouth, 9% from other community groups and 4% through a media campaign. Inclusion criteria were that an infant was aged between four and nine weeks at the point of recruitment and born between 37 and 42 weeks gestation. Both bottle-fed and breast-fed infants were included and those of both smoking and non-smoking parents. Exclusion criteria were: complications during birth or pregnancy which had raised medical concerns for the baby's welfare; congenital conditions; and gastro-intestinal problems for which medication was being prescribed.

2.4. *Materials.*

2.4.1. *Diaries*. Previous research into crying and sleeping patterns has used parental diaries as this method is considered to be more reliable than retrospective questionnaires (Arikan, Handan, Sebahat, Orbak & Cifci, 2008) and can provide detailed descriptions of a child's schedule. Sadeh (2008, p 407) suggests, "When sleep schedule variables are the main outcome measure then…daily sleep logs are sufficient in most cases." As the current study required details of infant cry, sleep and feed routines a diary format that recorded all three infant behaviours was deemed to be both most accurate and simple for mothers to complete. In the current study, diaries were made-up of a page for each day of record keeping, with each day to be recorded from midnight to midnight (Appendix 1.1). Each page was divided into four main sections namely: feeding, day time naps, night waking and crying. These were divided into sub-sections for recording the time and duration of each behavioural event. Space was also allocated for participants to note anything out of the ordinary, for example if an infant did not feed as normal or for more general information, such

as illnesses or vaccinations. Written diary instructions explained the type of information that was required in each of the four sections and a day's example page was provided (Appendix 1.1). Participants were encouraged to continue on the following page if extra space was required. Individual mean frequencies and mean durations for the three infant behaviours under investigation were calculated from diary records.

2.4.2. *Temperament Questionnaire*. The Early Infancy Temperament Questionnaire (EITQ; Medoff-Cooper, Carey & McDevitt, 1993) is a standardised questionnaire based on the nine dimensions of temperament (Appendix 1.2) identified in the New York Longitudinal Study (NYLS) by Thomas, Chess and Birch (1968).. The EITQ was considered to be the most appropriate temperament questionnaire as it is the only known questionnaire designed specifically for infants as young as four weeks and has satisfactory test-retest reliability scores from 0.43 to 0.87. It consists of 76 items, each rated on a six-point scale of frequency from 'almost never' to 'almost always', yielding nine sub-scale scores (activity, rhythmicity, approach, adaptability, intensity, threshold, mood, distractibility, persistence) and, by summing these, a total EITQ (TEITQ) score is calculated which represents an overall measure of an infant's affect. Due to debate over which dimensions best reflect an infant's affect, as discussed above, the TEITQ score was used for analysis purposes in this study.

2.5. *Procedure*

The majority of parents were approached personally and those who were interested in participating completed a consent form (Appendix 1.4) and a personal details form (Appendix 1.5). The personal details form included questions on birth-order of their infant, pregnancy and delivery complications, feeding method and sex

and age of their infant. Participants were then provided with a diary and the EITQ and given standardised verbal (Appendices 1.1 and 1.5) and written instructions on how to complete each of them and were asked to record a minimum of three diary days. Participants took the diaries and EITQ home to complete over the following week. At the end of the week, the diary and EITQ were collected and the participants debriefed as to the purpose of the study.

Three measures of infant crying were collected namely, daily crying duration, frequency of crying per day and crying duration per episode. Four sleep measures were obtained namely daily nap duration, night sleep duration, total sleep per day and wake frequency. Two measures of infant feeding pattern were recorded; these were feed frequency per day and feed duration per feeding episode.

Crying duration data were positively skewed, so were normalised using the square root of each score (Tabachnick & Fidell, 2007). Transformed data identified two outliers which were removed from the analyses. Sleep data were normally distributed with no outliers. Feed frequency revealed two outliers which were removed from the relevant analyses. Because of the lack of previous empirical evidence for some of the predictor variables (e.g. birth-order with regard all three routines and sex and temperament with regard to feeding routines) stepwise linear regressions were carried out to identify which of the five independent variables were most closely related to infant crying, feeding and sleeping patterns.

3. Results

Seventy-four participants recorded a minimum of three days of infant behaviour and were included in the analyses. The number of days recorded ranged from between three and seven with a mode of four days. Not all parents provided all the independent variable information and Table 1 shows the breakdown of participants across the independent variables.

Table 2.1. Number of participants by level of independent variable.

	Feeding Method			**Sex**		**Birth-order**		**TEITQ[a]**	**Age**
	Breast	Formula	Mixed	Male	Female	First-born	Subsequent-born		
N	35	22	16	41	33	44	30	74	73
%	48	30	22	55	45	59	41	N/A	N/A

[a]TEITQ = Total EITQ score for all 9 dimensions

As can be seen from Table 2 not all dependent variable data was available for all participants due to missing or inaccurate recording. In particular, night sleep and night waking records were evidently the most difficult to record with 63 and 65 participants completing a minimum of three days data, for these dependent variables, respectively.

Table 2.2. Descriptive statistics for each of the dependent variables' (untransformed) data.

	N	**Mean**	**Range**	**SD[a]**
Cry duration (min)	67	44.77	149.25	32.12
Cry frequency/day	67	3.98	6.86	1.45
Feed frequency/day	73	7.12	9.10	1.66
Feed duration/episode (min)	71	22.97	34.42	8.01
Nap (min)	67	243.45	335.00	82.75
Night sleep (min)	63	563.48	395.80	90.50
Total sleep (min)	63	809.21	455.00	101.70
Wake frequency/night sleep	65	1.68	4.70	0.93

[a]SD = standard deviation

Before regression analyses were carried out to explore possible predictive relations initial Pearson Correlations between the independent variables and each of the dependent variables were calculated and are shown in Table 3.

Table 2.3. Pearson Correlation matrix of all independent variables for each of the dependent variables.

		Sex	**Feeding type**			**Parity**	**Age**	**TEITQ**
Infant Routines			Bf	Ff	Mix			
Cry duration N=65	*r*	-.17	-.04	-.03	.09	.08	-.09	.15
	p	.09	.37	.40	.25	.27	.22	.12
Cry frequency N=67	*r*	-.04	.01	-.13	.13	-.12	-.25*	.16
	p	.37	.47	.15	.14	.17	.02	.10
Feed frequency N=71	*r*	-.01	.42**	-.37**	-.09	-.17	-.17	.04
	p	.47	<.001	<.001	.24	.08	.08	.38
Feed duration N=68	*r*	.12	-.15	.003	.18	.29*	-.09	.20*
	p	.16	.10	.49	.07	.01	.24	.05
Nap duration N=65	*r*	-.13	-.12	.03	.10	.36**	-.22*	-.18
	p	.15	.17	.39	.20	<.01	.04	.08
Night sleep N=63	*r*	.05	.21	-.15	-.08	.11	.17	-.24*
	p	.35	.05	.12	.27	.19	.09	.03
Total sleep N=63	*r*	-.06	.09	-.03	-.07	.38**	.01	.31**
	p	.33	.24	.39	.29	.001	.48	.01
Wake frequency N=65	*r*	.23*	.29**	-.20	-.12	-.21*	-.18	.05
	p	.03	.01	.05	.17	.04	.08	.35

$p<0.05$, $^{**}p<0.01$. Bf = Breast-fed, Ff = Formula fed, Mix = Breast fed and Formula

As empirical evidence for the potential role of the independent variables, in a normative sample under 12 weeks of age is sparse and/or conflicting, stepwise regressions were conducted for each of the eight dependent variables. Table 4 shows

the results of the eight regression analyses. The five independent variables feeding method (breast-fed and formula-fed), sex, birth-order, temperament and age were entered together. For each of the analyses tolerance was greater than 0.1, and variance inflation factor less than 10. In addition the case to variable ratio was greater than 10:1.

Table 2.4. Results of regression analyses for the eight measures of infant crying, feeding and sleeping behaviours, entering sex, birth-order, feed method, temperament and age as predictor variables.

	Significant predictor variables	**Adjusted r^2 for all predictor variables**	***p* for entered variables**
Cry duration	No significant predictors	-.03	.66
Cry frequency	Age	.05	.04
Feed frequency	Breast-feeding	.08	.01
Feed duration	Birth-order	.07	.01
Nap duration	Birth-order	.12	<.01
Night sleep	No significant predictors	.06	.14
Total sleep	Birth-order and TEITQ	.17	<.01
Wake frequency	Breast-feeding and Sex	.09	.02

3.1. *Correlates of Infant Crying*

With regard to daily cry duration, and cry frequency (see Table 4). Infant age was significantly related to crying frequency, with 5% of the variance in cry frequency accounted for by infant age; with younger infants tending to cry more frequently than older infants (R=.25; $F(1, 64) = 4.27$, $p = .04$, $f^2 = .07$). None of the independent variables were significantly related to daily cry duration (R^2 = -.03, F (5, 60) = .60, p = .66).

3.2. *Correlates of Infant Sleeping*

As shown in Table 5, nap duration was related to birth-order (R = .37; F (1, 65) = 9.99, p = .002, f^2 = .16), with greater nap duration for subsequent-born infants than for first-born infants. Total sleep duration was related to birth-order and TEITQ (R =.45; F (2, 60) = 7.5, p = .001, f^2 = .25), whereby, subsequent-born infants slept significantly more than first-born infants during a 24-hour period.

Table 2.5. Infant sleep duration (nap and total sleep) in minutes for first-born and subsequent-born infants.

Birth-order	**Nap Duration (min)**		**Total Sleep Duration (min)**	
	Mean	SD	Mean	SD
First-born infants	219	75	779	103
Subsequent-born infants	281	81	858	790

There was also a tendency for those infants whose mothers had rated their temperament more positively to sleep more per day than those with more negative ratings. Unlike nap duration and total sleep, as can be seen in Table 4, night sleep was not significantly associated with any of the independent variables. Finally, wake frequency was significantly related to breast feeding and sex (R = .09; F (2, 62) = 5.19, p = .02, f^2 = .17). As can be seen from Table 6, breast-fed infants woke more frequently than formula fed infants and mix fed infants. Furthermore males tended to wake more frequently (mean = 1.9 times, SD = 1.1) than females (mean = 1.4 times, SD = .69).

Table 2.6. Mean wake frequency by feeding type

	Wake frequency		**Feed frequency**	
	Mean	SD	Mean	SD
Breast-fed infants	1.98	.80	7.9	1.50
Formula-fed infants	1.4	.90	6.2	1.20
Mixed-fed infants	1.48	1.0	6.8	.80

Further analysis, by two-way ANOVA, looking at the main effects of sex and feeding method (male/female x breast/formula/mixed feeding) on wake frequency revealed a significant main effect of sex (F (1, 59) = 4.42 p = .04) and of feeding method (F (2, 59) = .26, p = .04) but no interaction effect of these two variables (F (2, 59) = .19, p = .83)) (Figure 1)**.**

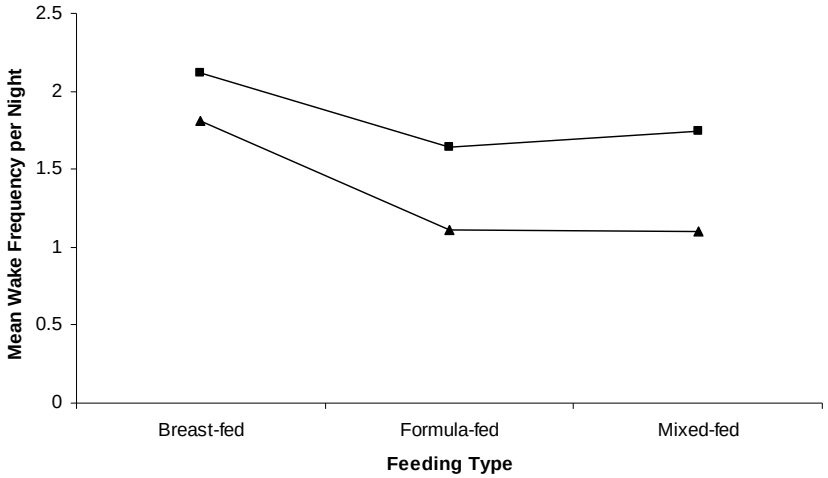

Figure 2.1. Mean wake frequency by sex and feeding type.

■ = males, ▲ = females

3.3. *Correlates of Infant Feeding*

Infant feed frequency was significantly related to feeding method. (R = .42; F (1, 68) = 14.72, p < .01, f^2 = .21). As shown in Table 6 breast-fed infants fed more frequently than formula-fed infants and mix-fed infants. However duration of feed per episode was most closely related to birth-order (R = .29; F (1, 67) = 6.30, p = .01, f^2 = .09) whereby first-born infants tended to take longer to feed (M = 25 minutes, SD = 7.8) than subsequent infants (M = 20 minutes, SD = 7.5).

3.4. *Correlates of Infant Temperament Dimensions*

To investigate further the possible relation among infant temperament and feed, cry and sleep routines correlational analyses were carried out between separate temperament dimensions and dependent variables. As can be seen from Table 5 all but two infant behaviours (cry duration and feed frequency) correlate significantly with at least one temperament dimension. As with the total EITQ score, the higher the dimension score the more negative the temperament rating. Therefore, as might be expected, a negative correlation was found between temperament dimensions (activity, approach, intensity and distractibility) and sleep measures (nap duration, night sleep and total sleep). It can also be seen from Table 5 that 'Intensity' is the dimension that correlates most frequently with the dependent variables; indeed, it correlates with at least one measure of all three infant routines of sleeping, crying and feeding.

Table 2.7. Correlation matrix of EITQ dimensions fore all dependent variables.

		EITQ dimensions								
Infant Behaviours		**Activity**	**Rhythmicity**	**Approach**	**Adaptability**	**Intensity**	**Mood**	**Persistence**	**Distractibility**	**Threshold**
Cry duration	*r*	.164	-.006	-.036	.80	.147	.196	.098	.011	.114
N=65	*p*	.096	.483	.387	.264	.121	.059	.219	.466	.182
Cry frequency	*r*	.108	.002	.083	.082	.252*	.142	-.094	-.002	.246*
N=67	*p*	.192	.493	.251	.255	.020	.125	.225	.495	.023
Feed frequency	*r*	-.081	.079	.033	.041	-.175	.100	.103	.090	.017
N=71	*p*	.252	.256	.392	.367	.072	.204	.197	.227	.444
Feed duration	*r*	.206*	-.111	.144	.068	.291**	.118	.028	-.009	.109
N=68	*p*	.044	.181	.119	.290	.008	.168	.411	.470	.186
Nap duration	*r*	-.202*	-.050	-.171	-.086	-.182	-.031	-.016	-.145	-.064
N=65	*p*	.050	.275	.070	.247	.062	.447	.450	.126	.321
Night sleep	*r*	.008	-.183	-.215*	-.059	-.216*	-.152	-.033	-.199	-.034
N=63	*p*	.474	.076	.045	.324	.044	.117	.398	.064	.396
Total sleep	*r*	-.111	-.169	-.382**	-.116	-.302**	-.128	.055	-.225*	-.069
N=63	*p*	.193	.093	.001	.182	.008	.159	.335	.038	.295
Wake frequency	*r*	.211*	-.099	-.145	.081	.062	.143	.179	.088	.131
N=65	*p*	.046	.422	.125	.262	.313	.127	.077	.243	.151

4. Discussion

The aim of this study was to investigate the infant characteristics associated with typically-developing four to ten week-old infant's crying, sleeping and feeding routines. In total two cry measures, four sleep/wake measures and two feed measures were used. Of the five factors, birth-order, sex, feeding method, temperament and age, all were significantly related to infant routines and all routines except cry duration were, to some degree, related to independent variables. Birth-order was found to be associated with feed duration, nap duration and daily sleep duration, with first-born infants showing longer feed duration and shorter nap and total sleep duration. In addition more positive ratings of infant affect tended to be related to longer total sleep duration. Consistent with previous research, breast-feeding was associated with more frequent wake and feeding episodes, and age was related to cry frequency. Both the sex of the infant and breast-feeding were related to wake frequency, with boys and breast-fed infants waking more frequently. None of the independent variables used in the current analyses were associated with infant cry duration.

Infants recruited to this study were at an age when cry duration is at its peak; yet only cry frequency was significantly associated with one of the independent variables, namely infant age. Frequency of crying decreased with increasing age, as hypothesised and confirms the findings of Brazelton (1962) and St James Roberts and Halil (1991). However, as outlined in the introduction, previous findings have been mixed with regard to factors related to cry duration. The current findings are consistent with those of Wolke *et al.* (1995) and Lee (2000), which found no effect of feeding method on cry duration. It is interesting to note that whilst these studies indicate that in a normative population crying is not related to feeding method, it has

been noted that some mothers resort to changing from breast-feeding to formula or mixed feeding in an attempt to reduce infant crying (Barr *et al.,* 1991). The current findings also support those of St James Roberts and Halil (1991) as there was no relation between sex or birth order and infant crying. In addition, the overall temperament measure was also not related to crying behaviour. However, on closer inspection of individual temperament dimensions, whilst no significant correlation with cry duration was found, cry frequency was found to be correlated to 'intensity' and 'threshold' dimensions, supporting previous findings (Carey 1972; Lehotonen, Korhonen & Korvenranta, 1994). It is possible that any potential effects of overall temperament, sex or birth-order, at this early age, when crying is at its peak, are too subtle to detect any consistent trends. As suggested by St James Roberts (1989), crying at this early age might be more a factor of neuro-developmental reorganisation. Specifically, Brazelton (1990) has suggested that some infants have an immature nervous system causing hypersensitivity and difficulty in regulating their response to stimuli. It is suggested, therefore, that further research in the effects of temperament on infant routines follows infants from this early stage through to four months when crying has settled to its base-line.

An unexpected finding was that sleep duration was significantly related to birth-order. Specifically, longer nap durations and longer total daily sleep were recorded for subsequent infants than for first-born infants. Whilst this is at odds with the findings of Thunstrom (1999), the sample in Thunstrom's study consisted of older infants (6 to 18 month-olds) than those in the current study. It is possible that the effect of birth-order on sleep duration is most evident during the first three months before sleep/wake patterns have developed a more circadian pattern. In part this longer total sleep was made up of longer nap duration, as discussed above, and to the

non-significant tendency for night sleep to be longer for subsequent infants. One potential explanation for the relation between maternal parity and infant sleep duration is that first time parents might tend to intervene earlier when an infant displays any sign of arousing, whereas mothers of subsequent infants may, through experience or because of competing child-care commitments, leave their infant to self settle again. Further research investigating mothers' intervention attitudes and behaviours might clarify the reasons for birth-order differences.

Interestingly, total daily sleep was also related to temperament, whereby infants with more positive ratings tended to sleep longer per day than those with more negative ratings. This is consistent with the findings of Weissbluth (1984), Touchette *et al.* (2005) and Touchette *et al.* (2009) who found a similar relation between temperament and sleep. On closer analysis the specific temperament dimensions related to sleep were 'approach',' intensity', 'activity' and 'distractibility', all of which correlated negatively with three measures of sleep. That is, more negative ratings on these dimensions were associated with less infant sleep. Nevertheless it seems that the exact relation between infant temperament and sleep routines will only become clearer with a consistency in research approach, choice of materials and sample age-range in studies that focus specifically on these relationships.

Quillin (1997) reported that at four weeks the mean number of wakings for an infant per night is 1.57. The current study obtained similar results with a mean wake frequency of 1.69 at a mean age of 6.7 weeks. The analyses indicated that frequency of waking was related to breast-feeding and sex. Consistent with previous research (Lee, 2000; Touchette *et al.,* 2005; Wolke *et al.,* 1995) infants who were exclusively breast-fed tended to wake more frequently than infants not exclusively breast-fed. This is likely to be a function of the need for breast-fed infants to be fed more

frequently than bottle-fed infants as breast milk is easier for infants to digest than formula, resulting in shorter intervals between feeding for breast-fed than for formula-fed infants (Mindell, 1997). Contrary to the findings of Tikotzky and Sadeh (2009), sex was also associated with wake frequency, with males waking more frequently than females.

As might be expected, feed frequency was significantly related to breast feeding and age. Breast-fed infants fed more frequently than non breast-fed infants, which is consistent with the current wake frequency findings and also the feed findings of previous research (Barr *et al.,* 1989; Wolke *et al.,* 1998). Furthermore, as hypothesised, feed duration was significantly related to birth-order. First-born infants tended to have longer feed durations per episode than subsequent-born infants. One possible explanation for this is that primiparous mothers are more likely to have more time to devote to feeding related activities such as 'winding', or interacting with their infant, than multiparous mothers or perhaps, due to experience, are more proficient at feeding their infant. Whilst Wolke *et al.* (1995) found that feed duration was related to night waking and breast feeding, the infants were older (minimum age 5 months) than those in the current study and birth-order data in the previous study were not discussed. Whilst overall infant temperament did not appear to be related to feeding behaviour, two dimensions of temperament namely 'activity' and 'intensity' showed significant positive correlations with feed duration, indicating that those infants with higher (more negative) 'activity' and 'intensity' ratings spent more time feeding. Perhaps those infants who respond with greater intensity, that is, cry more vigorously, are more likely to be regarded as crying by their mothers than those who cry less vigorously. Less vigorous crying might be more likely to be regarded as "fussing" thereby affecting the frequency with which the infant was reported to be crying.

The current results indicate that birth-order is related to both infant feed and sleep duration and consequently highlights potential differences between first-born and subsequent-born infants' routines. However, what is not yet clear is whether these differences are inherent in the infants or due to extrinsic influences, such as the mother's experience, attitudes or competing commitments. One possible explanation might be that parental strategies change with subsequent infants. Belsky, Taylor and Rovine (1984) found that mothers of first-born infants spend more time engaged in complex social interaction with their infant than do mothers of subsequent infants. Alternatively, it has been suggested that first-born infants are more often assisted deliveries than subsequent-born infants and that perhaps it is not birth-order per se that results in differences but infants with more stressful deliveries. Furthermore deWeerth and Buitelaar (2007) suggest that as first-born infants are more likely to experience birth complications it is possible that delivery complications might affect the parenting style of the mother.

The present study not only supports some previous research findings relating to infant crying, feeding and sleeping routines, but also raises awareness of a largely ignored factor, birth-order. Moreover, unlike studies that focused on specific problems in infant behaviours by recruiting clinical samples, the current study focused on the routines of typically-developing infants by recruiting participants from community settings and investigated all three major infant routines concurrently. Infants were also recruited at an early age, when crying is generally at its peak and sleep routines not yet established, as this can be a stressful period for most parents and developing a better understanding of an infant's normal routines at this age must be a priority.

Due to the potential bias obtained when parental retrospective reports are used or when parents are asked to make global judgments about their infants' behaviour this study adopted the more reliable method of parental diary keeping (Arikan, Handon, Sebahat, Orbak and Cifci, 2008). The data were collected over a period of one week and, therefore, is considered to be a reliable and valid measure of the infant's routine at that specific point in their development. Furthermore only those participants who collected a minimum of three day's data were included in the analyses.

Further work needs to be conducted to determine more clearly the effects of birth order on infant routines at this very young age. Such studies might seek to make the parental diary task easier for parents of very young infants, as the task of recording infant daily routines was evidently too demanding for some parents. Furthermore it is suggested that future research in this area would benefit from an alternative measure of infant temperament, such as a behavioural measure, or independent observation, as suggested by Morrell and Steele (2003), in addition to the maternal questionnaire to minimise the risk of systematic variance as a function of relying on the same source (ie. The mother) of information for both independent and dependent variables (shared method variance). Finally, a clearer operational definition of infant crying is required so that parents consistently distinguish between 'fussing' and 'crying'.

4.1. Conclusions.

In summary, all five infant factors of interest, namely birth-order, feeding method, temperament, age and sex were found to be related to infant routines. Only cry duration was not significantly related to any of the independent variables. The

current results indicate a relation between birth-order and the duration of infant feeding, napping and total sleeping and confirm earlier findings that breast feeding is related to more frequent feeding and waking. Further research is needed to explore which other intrinsic (such as delivery complications) and extrinsic factors (such as competing parental responsibilities or parental cognitions) might contribute to differences in infant routines. Equally important, however, is that future research in the domain of infant sleeping and feeding patterns recognises the potential role of birth-order and it is included as a potential factor influencing infants' routines.

CHAPTER THREE

INFANT SLEEP: THE ROLE OF MATERNAL PARITY, MENTAL HEALTH AND INFANT TEMPERAMENT.

Abstract.

Research investigating thee effect of maternal mental health on infant routines typically investigates infants beyond the first six months postpartum and maternal mental health in isolation (e.g. Morrell, 1999; Thunstrom, 1999 and Zuckerman, Stevenson & Bailey, 1987). Furthermore, Kaley *et al*. (2012) found maternal parity and infant temperament to be related to infant sleep duration. It was hypothesised that infant temperament and maternal parity might moderate the effect of maternal mental health on infant sleep. Method: 25 mother-infant dyads participated in the study. Sleep data was collected by means of a sleep diary (Appendix 1.1) and mothers completed the Early Infancy Temperament Questionnaire (Appendix 1.3) and the Beck Depression Inventory (BDI) – second edition (Appendix 2.1). Results: *t*-test analysis revealed that mothers with high BDI scores had infants who slept less than those with low BDI scores. Whilst no main effect of parity was found from a two-way ANOVA the non-significant trend suggested a possible interaction effect between parity and maternal mental health. Similarly, with regard to temperament the results of a two-way ANOVA revealed no significant main effect of temperament and no interaction effect with maternal mental health on infant sleep. However there was a non-significant trend for those infants who were rated as more temperamentally easy to sleep longer per day than those who were rated as more temperamentally difficult. Conclusion: Maternal parity might moderate the effect of maternal mental health on infant sleep whereas infant temperament might be a separate influencing factor. Further studies with larger sample sizes are required.

1. Introduction.

For most infants the primary carer is the mother. It is not surprising, therefore, that much of the research investigating infant routines has focused on the characteristics of the mother and her parenting style. As mentioned in the literature review (section 1.2), studies into infant sleep routines have often focused on maternal cognitions, and maternal mental health and the concomitant maternal behaviours (Bayer, Hiscock & Hampton *et al*., 2007; Burnham, Goodwin-Jones, Gaylor & Anders, 2002; Sadeh, Tikotzky & Scher, 2010; Tikotzky & Sadeh, 2009).

Maternal cognitions, such as concern about the infant's health and about competence as a mother, have been found to be related to infant sleep problems. (Morrell, 1999; Sadeh, Flint-Oftir, Tirosh and Tikotzky, 2007). However, cause and effect has not been established. It is not clear whether parents who have difficulty with limit setting cause infant sleep problems or whether infant sleep problems cause parents to relax their ideas on limit setting. Clearly advice to parents on limit setting will not guarantee an infant who sleeps well if the latter is the case. Evidence to suggest that negative maternal cognitions affect an infant's sleep comes from the work of Tikotzky and Sadeh (2009) who, in a longitudinal study of infants from one to twelve months, found that maternal prenatal cognitions, emphasising infant distress and the need for parental involvement, were associated with more frequent night waking at six months and twelve months. In contrast, the importance of limit setting was associated with more consolidated infant sleep at these ages. Moreover they found that mothers who emphasised infant distress upon waking were more likely to be involved in bed-time soothing, which in turn was related to poor infant sleep

patterns, thus indicating a potential mediating role of maternal soothing in infant sleep problems.

Maternal mental health is closely related to maternal cognitions and a characteristic that might have implications for mother-infant interactions and consequently infant routines. Oates (1998, p556) has argued that postnatal depression might interfere with the mother's ability to 'sustain contingent relations' with her infant which in turn might delay the infant's development. As highlighted in the literature review (section 1.2) Sadeh and Anders (1993) argued that parental personality and psychopathology are amongst the most important maternal characteristics affecting infant sleep and support for this comes from the findings of Zuckerman, Stevenson and Bailey (1987) who concluded, from their prospective study, that the negative maternal feelings were not a consequence of the infants' sleep disturbance. In contrast, Hiscock and Wake (2001) and Wake *et al.* (2006) concluded that poor infant sleep is a risk factor for maternal well-being and maternal depression. As has been illustrated, much of the research has been undertaken with infants beyond six months of age. Fewer studies have focused on sleep problems in the first few weeks postpartum. Bayer *et al.* (2007) suggested that whilst infant sleep problems are common in the second six months of life the prevalence of sleep problems prior to this is less well established, arguing that, "many clinicians consider frequent night waking to be normal and not problematic at this age,… contrary to parental opinion" (p. 66). A community study found 23% of parents with infants as young as three months reported 'sleep problems' (Armstrong, Quinn & Dadds, 1994) and in another study depressed mothers, of infants between four and eight weeks postpartum, reported more infant sleep difficulties in the first few weeks than non-depressed mothers (Dennis and Ross, 2005).

Sadeh and Anders (1993) and Sadeh, Tikotzky and Scher (2010) emphasise the transactional nature of the relation between infant sleep and parental responses. At a more distal level they highlight cultural, environmental and familial pressures that affect and are affected by both style of parenting and infant characteristics. Accordingly these factors, in turn, affect the mother-child relationship and concomitant parenting routines, ultimately affecting the sleep pattern of the infant.

One of the factors identified by Fish and Stifter (1993) as an important variable in this transactional relation is maternal parity. They found that multiparous mothers of five-month infants reported greater confidence and effectiveness as a mother than primiparous mothers. More recently, Kaley, Reid and Flynn (2012) with a community sample of 70 infants found parity to be the main predictor of sleep duration at four to ten weeks postpartum, with infants of multiparous mothers sleeping longer than those of primiparous mothers. Kaley *et al.* (2012) found infant temperament to be a predictor of infant sleep duration, whereby those infants whose temperaments had been rated more positively (that is temperamentally easier) by their mothers tended to sleep longer than those rated more negatively (temperamentally more difficult). These temperament findings are consistent with those of Halpern Anders, Garcia Coll and Hua (1994) who found infant temperament at both three weeks and three months to be related to sleep-wake indices. However, the relation between infant sleep and infant temperament might be more complex involving maternal responses to infant temperament or infant sleeping. For instance, Morrell and Steele (2003) found sleep problems in older infants (14-16 months) were related to 'fussy' temperament together with maternal cognitions about limit setting. Crockenberg and McClusky (1986) suggested that temperament might influence parental responses only under certain conditions, such as level of support available to

the mother from family and friends and Pauli-Pott, *et al*. (2000) found that mother-infant interactions only affected infant emotionality when maternal depression was also present. Furthermore, Belsky's (2005) 'Differential Susceptibility Hypothesis' proposes that children vary in the extent to which they are affected by their child-rearing experiences and that infants with 'difficult' temperaments are disproportionately affected by parenting quality. It might be expected, therefore, that infants with difficult temperaments, whose mothers experience higher degrees of depression, might be slower to establish a sleep routine.

Therefore, the question raised by previous research is: does maternal parity or infant temperament have a role in the relation between maternal mental health and infant sleep? Kaley *et al* (2012) found that infants of primiparous mothers sleep less than infants of multiparous mothers and that temperamentally difficult infants sleep less than temperamentally easy infants. Given that the relation between infant sleep and maternal mental health is well established, maternal parity or infant temperament might interact with maternal mental health in affecting infant sleep. Thus we predicted that in a sample of typically-developing infants first-time mothers, who score higher on depression measures will have infants who sleep less than multiparous mothers or those low in depression. Similarly we predicted that mothers with higher depression scores and with temperamentally difficult infants would have infants who slept less than those with temperamentally easy infants or those who score lower on measures of depression.

2. Method.

2.1 *Ethics.*

Ethical approval was granted in February 2009 by Durham University Psychology Department Ethics Committee. All participants were made aware that they were free to withdraw at any time and that they could choose not to answer all questions on The Beck Depression Inventory II. Information on local and national support groups was provided in the participant information. Participants were informed that individuals would not be identifiable in any subsequent reports and were allocated an anonymous identification number to be used on the questionnaire. The record of participants name and number was stored separately and all data were stored in accordance with the Data Protection Act 1998.

2.2 *Design.*

This study formed the second phase of the infant behaviour study. A cross-sectional design was used whereby mothers' scores on the BDI were categorised as either high or low using a median split and the two respective groups of infants compared on sleep duration. The potential interaction effect between maternal mental health and parity on infant sleep duration and the interaction between maternal mental health and infant temperament on infant sleep were then explored.

2.3. *Participants.*

Twenty-eight mothers with infants aged between seven and 12 weeks (mean = 47 days, standard deviation = 12) participated in this study. Of the participating infants, 14 were male and 18 were first-born. Of this sub-sample of the original

participants, 77% had been recruited from Sure Start Children's Centres in two local authority areas in the North East of England, 19% by word of mouth, and 4% through a media campaign. Inclusion criteria were that the infant was born between 37 and 42 weeks gestation. Breast-fed infants (n=14), bottle-fed infants (n=7) and mixed fed infants (n=7) were all included as were those of both smoking and non-smoking parents. Exclusion criteria, at the point of recruitment in phase1, included complications during birth or pregnancy which had raised medical concerns for the infant's welfare, congenital conditions, and gastro-intestinal problems for which medication was being prescribed. Chi square analyses revealed no significant differences in the profile of the phase 1 and phase 2 samples in terms of sex (χ^2 (1) = .88, p = .48), feeding method (χ^2 (2) = 1.64, p = .26) and birth order (χ^2 (1) = 1.16, p = .35). *t*-tests showed that the phase 1 sample and phase 2 sample were not significantly different in age or temperament scores (t (75) = .12, p = .91; t (71) = .60, p = .55 respectively) as measured by the Early Infancy Temperament Questionnaire (EITQ; Medoff-Cooper, Carey & McDevitt, 1993) as detailed in Chapter Two.

2.4. *Materials.*

Mothers completed the Beck Depression Inventory second edition (BDI-II, Beck, Steer & Brown, 1996). This questionnaire is designed to assess the severity of depression in adults and adolescents aged 13 years and older. The BDI consists of 21 groups of statements to which participants indicate which statement in that group best reflects how they are feeling. Participants' responses are scored by rating each on a four-point scale ranging from zero to three. A total BDI score is obtained for each participant by summing the 21 items (Appendix 2.1). The BDI was chosen as this

instrument has good reliability (.92), and its overall score provides a good indicator of the severity of depressive symptoms.

Data from the first phase of this larger behavioural study were also included in the analysis, namely, data from the Infant Routine Diary, in which infant feeding, sleeping and crying routines had been previously recorded (as reported in Chapter Two). Diaries consisted of a page for each day of record keeping, with each day to be recorded from midnight to midnight. Each page was divided into four main sections namely: feeding, daytime naps, night waking and crying. These were divided into sub-sections for recording the time and duration of each behavioural event. Space was also allocated for participants to note anything out of the ordinary, for example if the infant did not feed as normal or for more general information, such as illnesses or vaccinations. Written diary instructions explained the type of information that was required in each of the four sections and a day's example page was provided. Participants were encouraged to continue on the following page if extra space was required. The data from these diaries included times and durations of the infants' feeding, sleeping, night waking and crying episodes (Appendix 1.1).

Other phase one data included infants' scores on the Early Infancy Temperament Questionnaire (EITQ; Medoff-Cooper, Carey & McDevitt, 1993)(Appendix 1.3). This assessment tool is based on the nine dimensions of temperament identified in the New York Longitudinal Study (Thomas Chess & Birch, 1968). The EITQ was the assessment tool of choice as is designed specifically for use with infants from four weeks of age. It consists of 76 items, each rated on a six-point scale of frequency from 'almost never' to 'almost always', yielding nine sub-scale scores (activity, rhythmicity, approach, adaptability, intensity, threshold, mood,

distractibility, persistence (Appendix 1.2). From this a total EITQ score is calculated giving an overall measure of infant affect.

2.5. *Procedure.*

Following the debriefing of participants in the first phase of the Infant Behaviour Study, two weeks after participants completed the first phase data, all participants were given the opportunity to continue into this second phase. Those who consented were given the BDI questionnaire together with a second phase information leaflet. Participants were asked to complete the questionnaire in their own time and return it in an envelope provided. Participants were informed that the information would be confidential and were allocated numerical IDs to provide a degree of anonymity.

3. Results.

BDI data were positively skewed, so were normalised using the square root of each score (Tabachnick & Fidell, 2007) and all analyses were calculated using the transformed BDI data. To investigate whether there was a significant main effect of maternal mental health on infant sleep and main or interacting effects of parity and temperament, independent *t*-tests and two-way ANOVAs were conducted. A median split was applied to the BDI scores to categorise mothers into those with higher scores (2.4 and higher) and those with lower scores (2.3 and lower) of depression.

As can be seen from Table 1, a general trend across all sleep periods was found, with those infants of mothers with higher BDI scores sleeping less than those infants whose mothers had lower BDI scores. In particular a significant effect of

maternal mental health on total infant sleep was found (t (21) = 2.35, p <.05, d = 1.03); that is mothers who scored higher on the BDI had infants who slept significantly less in total (M =772 min/day; SD = 111.66) than those who scored lower on measures of depression (M = 874 min/day; SD = 82.63).

Table 3.1. t-test results for the effect of maternal status on infant sleep duration.

	Maternal Status	N*	Mean (min)	SD	t	df	p	d
Day-time nap	Low BDI	10	298	84.9	1.55	23	.135	
	High BDI	15	245	84.1				
Night sleep	Low BDI	9	571	111.9	.921	21	.368	
	High BDI	14	530	96.8				
Total sleep	Low BDI	9	874	82.6	2.35	21	.029	1.02
	High BDI	14	772	111.7				

SD = standard deviation, df = degrees of freedom.

*Of the 28 participants completing the BDI 5 participants had missing sleep data (nap, night or total) and 1 participant had missing EITQ data.

To test for a possible interaction effect between parity and maternal mental health on infant total sleep duration, a two-way ANOVA (primiparous/multiparous mothers x high/low BDI scores) was performed. Table 2 shows mean total sleep duration for infants by maternal parity and BDI scores. On this occasion the tendency for infants of mothers with low BDI scores to sleep longer than those with mothers with high BDI scores approached significance (F (1,19) = 3.49, p = .08). There was no main effect of parity found in this sub-sample of phase one participants (F (1, 19), = 1.0, p = .33). Table 2 shows a trend, for those infants of mothers with lower BDI scores to sleep longer per day than those of mothers with higher BDI scores and that this was most marked for first-born infants (F (1,19) = 3.1, p = .09). As can be seen

from Table 2, however, the numbers of participants in the respective groups are small so caution needs to be exercised in drawing conclusions.

Table 3.2. Mean infant daily sleep duration (minutes) by maternal mental health and parity.

Maternal Status		N	Mean	SD
Low BDI Scores	Primiparous	6	884	100.40
	Multiparous	3	852	32.20
High BDI Scores	Primiparous	9	730	83.13
	Multiparous	5	847	124.70

To explore a potential interaction effect between infant temperament and maternal mental health on infant sleep duration, a median split was performed on the TEITQ scores, dividing infants into higher (more temperamentally difficult) and lower scorers (more temperamentally easy) and a two-way ANOVA (high/low TEITQ scores x high/low BDI scores) was carried out, the means and standard deviations for which are displayed in Table 3. The results indicated that, once again, there was a significant main effect of maternal mental health (F (1, 19) = 4.67, p <.05) but no interaction effect (F (1, 19) = .003, p = .96).

Table 3.3. Mean infant sleep duration (minutes) by infant temperament and mothers' maternal mental health scores.

Infant Temperament Scores	Mothers' BDI Scores	N	Mean	SD
Low TEITQ Scores	Low BDI Scores	6	897	74.40
	High BDI Scores	8	804	127.80
High TEITQ Scores	Low BDI Scores	3	827	92.80
	High BDI Scores	6	729	75.90

No significant effect of infant temperament was found on infant sleep duration (F (1, 19) = 2.65, p = .12). Although those infants with lower TEITQ ratings tended to

have slightly longer sleep durations (M = 851 min/day) than those with higher TEITQ ratings (M = 779 min/day). Neither was there a significant interaction effect of temperament and maternal mental health (F (1, 19) = .003, p = .96), but as can be seen in Table 3, participant numbers were again small and might obscure any significant effects.

4. Discussion.

The relation between infant sleep and maternal mental health is well established (Sadeh & Anders, 1993; Hiscock & Wake, 2001; Wake, Morton Allen & Poulakis *et al.,* 2006; Zuckerman, Stevenson & Bailey, 1987). Kaley *et al* (2012) also found a relation between maternal parity and infant sleep and between infant temperament and infant sleep. The current study had two main aims, first, to examine whether an interaction effect between parity and maternal mental health on infant sleep was present in the sample of young infants and secondly, to determine whether there was an interaction effect between infant temperament and maternal mental health on infant sleep. The trend in the data is consistent with the findings of Dennis and Ross (2005) indicating that even with young infants (under 12 weeks) mothers with lower scores on measures of depression have infants who tend to sleep more than mothers with higher scores. Indeed, this trend was seen across all three measures of infant sleep although only significant for daily sleep duration.

Potential interaction effects on infant daily sleep duration between mothers' mental health and parity were then explored. Contrary to phase-one results, the results of this second phase sub-sample indicated no main effect of parity on infant sleep. Whilst no significant interaction effect between parity and maternal mental health was

found the results did indicate a trend for all multiparous mothers (both high and low on depression scores) tending to have infants with longer sleep durations. Similar to the findings of Fish and Sifter (1993), only those primiparous mothers with high BDI scores had infants showing relatively short sleep durations and might be indicative of a potential effect of parity on maternal behaviour and attitudes either directly or through moderating the influence of other determinants of parenting, such as maternal mental health. Nevertheless, perhaps due to the small sample size, this trend was not significant. According to Fish and Sifter (1993), much of the research into factors affecting infant sleep has either not controlled for maternal parity or has specifically selected first-time mothers. There needs to be further investigation into the potential effect that parity has on infant routines as either a main or moderating variable.

A potential interaction effect between infant temperament and maternal mental health was explored. Once again a significant effect of maternal depression was found on infant sleep duration and a non–significant trend for a main effect of infant temperament. Irrespective of infant temperament, infant sleep duration was shorter for those infants whose mothers scored higher on the BDI, but those infants rated as more temperamentally difficult tended to sleep for shorter durations than those rated as temperamentally easy. Whilst the effect of temperament was not significant the trend is in line with the work of Halpern, Anders and Garcia Coll (1994) who found that infant temperament even at as young as three weeks and twelve weeks is related to sleep-wake indices and lends support for Belsky's (2005) Differential Susceptibility Hypothesis.

Clearly these cross-sectional data do not permit cause and effect conclusions to be drawn, but it is indicative of multi-factorial and transactional relationships in infant sleep routines even as young as 12 weeks. Specifically, it draws attention to the

potential roles that maternal parity, infant temperament and maternal mental health might play in infant sleep routines. However the number of participants who continued into this second phase of the Infant Behaviour Study is small and it is possible that the sample size and consequent small sub-group numbers have masked true results. The potential main and moderating effects of maternal parity and infant temperament are might be worth exploring further with a larger sample.

CHAPTER FOUR

A MICROGENETIC STUDY OF INFANT CRYING AND NIGHT WAKING FROM 6 TO 13 MONTHS

Abstract.

The purpose of this prospective study was to closely examine the developmental trajectory of infant sleep and cry routines over the second half of the first year. The incidence and pattern of crying and night waking in infants were examined as was the extent to which sex, parity, method of feeding and temperament were associated with higher night waking and higher infant crying. The study also examined the extent to which sleep patterns (measured at pre-12 weeks) were predictive of later routines (6 to 13 months). A sample of 34 mothers completed and returned an Infant Routines Questionnaire every fifth week from 6 months. The questionnaire addressed infants' feeding, crying and sleeping routines (Appendix: 3.1).

The results highlight the intra-individual variation in infant routine across this period. Five categories of infant night-waking were identified (expected, variable, reverse, consistent and delayed) and three categories of infant cry routines (average, variable and transitioning). No effect of sex of the infant or birth order was found on either wake or cry category. Results indicated that breast-fed infants were significantly more likely to be classified as having a 'transitioning' cry pattern. No effect of wake category was found on infant temperament ratings but infants who were classified as variable criers had previously been rated more negatively on temperament measures by their parents at 12 weeks of age.

In conclusion, infant wake routines seem more susceptible to parental routines than infant cry patterns, thus accounting for the greater variability. The relatively stable cry routines might be more reflective of infant temperament.

1. Introduction.

For many years researchers have tried to map sleeping and crying routines during the early development of infants and to identify factors that will predict which infants will be wakeful and which will cry more in later life (Wolke *et al.,*1995; Goodlin-Jones, Burnham, Gaylor & Anders, 2001; Tikotzky & Sadeh, 2009). Whilst general sleep and cry patterns have been identified (Anders & Keener, 1985; Brazelton, 1962; St James-Roberts & Halil, 1991; Touchette, Petit, Tremblay & Montplaisir, 2009) there is considerable individual variation (Burnham, Goodlin-Jones, Gaylor & Anders, 2002) which means that a typical trajectory is difficult to identify as are the factors that might be responsible for variations in these trajectories.

1.1.*Infant Sleep-Wake Pattern*.

As described in Chapter One (section 1.1), soon after birth infant sleep is made up of relatively short alternate sleep and wake episodes throughout the day and night (Iglowstein, Jenni, Molinari & Largo, 2003), with the longest duration of any one sleep episode being about four hours (Anders & Keener, 1985). By six months of age the duration of infant sleep has reduced to 13-14 hours per day, largely due to a reduction in nap time (Iglowstein *et al*., 2003). In addition, at six months an infant is able to sustain longer sleep episodes of approximately six hours (Anders & Keener, 1985). In a large scale prospective study Wake, Morton-Allen, Poulakis, Hiscock, Gallagher, and Oberklaid (2006) found that between two and 12 months of age the number of infant sleep episodes decreases whilst overall duration remains more or less stable at a mean of 13-14 hours. However, there appears to be considerable inter-individual variability in total sleep duration. For instance, in a cross-sectional study by

Sadeh, Mindell Luedtke and Wiegand (2009), infants between three and 11 months of age had daily sleep durations that ranged between nine and 16 hours per day.

The feature of infant sleep routine that is particularly pertinent to most parents is night waking, especially those episodes during which the infant signals to the parent. As mentioned in the literature review Anders Halpern and Hua (1992) found that the percentage of infants waking and signalling reduces from 90% during the first few weeks after birth, to 50% by three months of age. Moreover, Armstrong, Quinn and Dadds, (1994) have estimated that by 12 months, between 20 & 30% still wake and signal, and Moor and Ucko (1957) reported that 10% of the infants they followed over the first 12 months never completely settled. Consequently this study focuses on those infants who both wake and signal to the parents but will be referred to simply as 'waking'.

The prevalence of infant sleep problems have been the focus of some research For instance Anders *et al*. (1992), in a longitudinal study, found that as many as one third of a sample of eight-month-old infants were identified as 'problem' sleepers (parentally defined) by their parents. Indeed, there is some indication that as many as 30% of children have a sleep problem (parentally defined) at some point during the first three to four years (Sadeh *et al*., 2009 and Zuckerman, Stevenson & Bailey 1987). The extent to which a sleep-wake problem is a stable characteristic of the infant has also been a matter for research. Gaylor, Goodlin-Jones and Anders (2001) found that self-soothers at 12 months were less likely to have sleep problems at two years. Indeed, the stability of problem waking is sometimes interpreted as an indicator of infant temperament for instance Zuckerman *et al*. (1987) found that 41% of those with sleep problems at eight months had sleep problems at three years and that these persistent sleep problems were associated with behaviour problems. Alternatively

Hayes, McCoy, Fukumizu, Wellman and DiPietro (2011) suggest that whilst infant waking and temperament are relatively stable they are also independent of each other. In contrast Moore and Ucko (1957) reported that of those infants who had settled at 3 months 50% began to exhibit night waking at 12 months. They suggest that if the developmental changes, that occur as the infant is adapting to a diurnal pattern of sleep, are disrupted by illness or change beyond the fourth month, the automatic gravitation to the diurnal cycle might be lost. Similarly, in a sample of 'at risk' infants Schmid, Schreier and Meyer (2010) found no long-term stability in infant problem waking and Lam, Hiscock and Wake (2003) found that less than one third of children who had problem waking at eight months went on to have sleep/wake problems at three to four years of age.

As highlighted in the literature review (section 1.1) other possible influencing factors of wake routine that have been explored include sex, birth-order, and feeding method (Anders *et al*., 1992; Thunstrom, 1999 and Tikotzky & Sadeh, 2009). More recently in a study investigating a community sample of 74 infants by Kaley, Reid and Flynn (2012), both breast feeding and the sex of the infant predicted wake frequency in infants under 12 weeks. Males and breast-fed infants were found to wake more frequently than females and formula-fed infants. Whilst birth order effects were also present for total sleep duration (first born infants sleeping longer than subsequent born infants) no effect of birth order or temperament was found on night waking measures.

Importantly, there is no agreed upon definition of what constitutes a sleep problem, not least because of the changes in infant sleep pattern with age and because of differing parental expectations at different points in an infant's development. Richman (1981) defined sleep problems in one-year-old infants as night waking

episodes that occur on at least four nights per week that require parental intervention. Zuckerman *et al*. (1987) defined a sleep problem as an infant taking more than one hour to return to sleep or waking three or more times per night. Whereas Anders *et al.* (1992) and Wake *et al*. (2006) used parentally driven definitions, whereby parents rated child's sleep pattern on a five-point from very large problem to no problem. Anders argued that no other definition of problematic waking had been accepted for infants of eight months. Consequently this lack of an agreed definition has limited the comparability of studies in problematic waking.

1.2. *Infant Cry Pattern*:

Research into the possible factors affecting infant cry patterns is somewhat less controversial than infant waking. Typically, studies have found that boys cry more frequently and are more difficult to settle than girls (Lundqvist & Sabel, 2000; Wolke, Schmid, Schreier & Meyer, 2009) although St James-Roberts and Halil (1991) found that age was the most influential factor in infant crying. Similarly, Kaley *et al.* (2012) in a sample of infants under 12 weeks found that age best predicted cry frequency, while other factors such as sex, parity, feeding method and temperament had no effect on cry frequency or duration. However the ages of infants in these studies range from 48 hours to 12 months postpartum which compromises the comparability of the studies.

Even though there have been attempts to define what is meant by a cry problem in early infancy, once again definitions vary. Alvarez and St James-Roberts (1996) have defined those infants for whom excessive crying (i.e. More than 3 hours per day) continues beyond the initial three months as having persistent excessive infant crying, with some studies reporting an incidence of 5% to 10% of infants (Wolke, 2003; Von

Kries, Kalies and Papouseck, 2006). Wolke, Schmid *et al*. (2009) included 'above average' crying as one of their definitions of problem crying. Wake *et al.* (2006) used parents' ratings of whether the child had a cry problem or not. Wake *et al*. argue that evidence for the prevalence of a cry problem is mixed, in part due to various definitions and in part due to the apparent instability of a cry problem. They found that 55 of the 70 infants with a problem in crying at two months exhibited resolution by four months and an additional 29 participants developed a 'new' crying problem and fewer than 6% had a cry problem at both two and four years of age. One proposal has been that while cry-fuss problems are prevalent at every age between two and 24 months they are transient and not indicative of the infant's temperament (Wake *et al*., 2006). deWeerth, *et al.* (1999) in a longitudinal study of five infants found intra-individual variability between birth and ten months, with crying becoming more stable between 10 and 15 months.

Research has often relied on cross-sectional data to examine sleep and cry routines in infancy (Alvarez & St James-Roberts, 1996; Goodlin-Jones *et al*., 2001; Sadeh *et al.,* 2009), and when longitudinal studies have been used the period between measures is usually several months (Wolke *et al*., 2009). Such an approach precludes the monitoring of small, frequent, changes during this period of rapid development. On some occasions the sample is drawn from a specific population, the results of which are more difficult to generalize to the whole population (e.g. Schmid, Schreier, Meyer and Wolke, 2009). To address these issues, the current prospective study collected wake and cry data from a community sample of infants between six months and 13 months, at five-weekly time points, in order to monitor developmental changes within the infant across this period. In addition, data were compared to cry and wake data collected from the same sample of infants during their first three months

postpartum (presented in Chapter Two). Such a design comes under the microgenetic method which examines change as it is happening. This method has been used across diverse domains such as theory of mind and inhibitory control (Flynn, 2006; 2007; Flynn, O'Malley & Wood, 2004) and there has been support for this approach to be extended to other research domains (Flynn & Siegler, 2007).

This prospective, microgenetic study examined closely the developmental trajectory of infant sleep and cry routines over the second half of the first year in a community sample of infants. Individual trajectories in cry and wake routines and the incidence of high crying and waking were investigated. We also examined whether early cry and sleep patterns were predictive of later routines. Finally we examined the role of sex, birth order, method of feeding, and temperament on infant wake and cry problems.

2. Method.

2.1. *Ethics*.

Ethical approval was granted in June 2009 by Durham University Psychology Department Ethics Committee. All participants were made aware that they were free to withdraw at any time and that they could choose not to answer all questions on the Infant Routines Questionnaire. Participants were informed that individuals would not be identifiable in any subsequent reports and were allocated an anonymous identification number to be used on all questionnaires. The record of participants name and number was stored separately and all data were stored in accordance with the Data Protection Act 1998.

2.2. *Participants*:

From an original sample of 74 infant-parent dyads presented in Kaley, *et al.* (2012) who had participated in an initial behaviour study (Chapter Two), 40 participated in this new phase. Four participants withdrew from the study and two returned only three of a possible seven questionnaires and so were excluded from the analysis. Inclusion criteria were that an infant was born between 37 and 42 weeks gestation. Both bottle-fed and breast-fed infants were included and those of both smoking and non-smoking parents. The exclusion criteria were: Complications during birth or pregnancy which had raised medical concerns for the baby's welfare and the presence of congenital conditions. The profile of participants who continued into this phase was similar to that of the original sample, with no significant difference in feeding type (breast, formula or mixed) (χ^2 (2) = 40, p = 1), sex (χ^2 (1) = 1.4, p = .25) or maternal parity (χ^2 (1) = .60, p = .49).

Table 4.1. Average age of infants at the seven time points (Tn) of questionnaire distribution.

	T1	T2	T3	T4	T5	T6	T7
Average age of infant in weeks	28	33	38	43	48	53	58
Age in months	6.5	8	9	10	11	12	13.5

2.3 *Design*:

When infants reached six months of age their parents were contacted and invited to take part in this phase of the study. Parents were sent a letter inviting them to participate, an information leaflet, the first copy of the Infant Routines Questionnaire (IRQ) and a stamped-addressed return envelope. Thereafter parents completed an IRQ every fifth week, until their infant reached a maximum of 14 months. A total of seven IRQs were sent to each participant during the eight month period.

2.4. *Materials:*

An IRQ (Appendix 3.1) was developed specifically for the purposes of this study. This quantitative questionnaire consisted of seven questions asking parents to detail the frequency and duration of the infant's feeding, sleeping and crying routines over the previous three days (or most recent normal routine if the last three days were atypical due to illness, etc).

The open-ended questions were:

- *How often do you breast-feed your baby?*

  Always, most times, occasionally, never

On average:

- *How often does your baby wake through the night?*
- *How long is your baby awake each time?*
- *How is your baby usually settled back to sleep?*

On average

- *How many crying episodes does your baby have per day?*
- *How long do these episodes last?*
- *What are the best ways of comforting your baby?*

Temperament data for this sample of infants was collected in an earlier study (Chapter Two) between the ages of four and nine weeks using the Early Infancy Temperament Questionnaire (EITQ) developed by Medoff-Cooper, Carey and McDevitt (1993) (Appendices 1.2 and 1.3). It consists of 76 items, each rated on a six-point scale of frequency from 'almost never' to 'almost always', yielding nine sub-scale scores (activity, rhythmicity, approach, adaptability, intensity, threshold,

mood, distractibility, persistence). By summing these, a total EITQ (TEITQ) score is calculated which represents an overall measure of an infant's affect. Due to debate over which dimensions best reflect an infant's affect, as discussed above, the TEITQ score was used for analysis purposes.

2.5. *Procedure:*

Parents were asked to complete and return an IRQ as soon as possible upon receipt. If they agreed to participate, parents were sent an IRQ every fifth week thereafter. When a questionnaire was not returned by a parent the next was sent on its due date. If two consecutive questionnaires were not returned the participant was contacted to enquire whether they wished to continue to participate in the study. On completing the study, parents were debriefed as to its purpose and given a small token of thanks (a baby T-shirt or buggy book).

3. Results and Discussion.

The purpose of this prospective study was to investigate the developmental trajectory of infant sleep and cry routines, for the group and individually, over the second half of the first year, in a community sample of infants. General trends were explored and intra-individual variability across the latter part of the first year investigated. The aim was to categorise infants according to their individual trajectories in crying and waking and to determine to what extent factors such as an infant's sex, birth-order, method of feeding and temperament are associated with the different categories of cry and wake pattern. The study also examined whether early cry and sleep patterns are predictive of later routines.

The patterns of feeding, night waking and crying are discussed in three separate sections. Within each of these sections descriptive statistics are used to explore group trends in behaviour over the seven study months. For cry and wake data the inter-correlations within each behaviour pattern are calculated to examine continuity over time. Following the three sections the relation between biographic characteristics and cry and wake data are investigated using Chi square analyses and ANOVAs.

3.1. Descriptive analysis:

Not all participants returned data for every time point. Table 2 shows the number of responses and mean response for the dependent variables across the period of study. Mean frequency scores are calculated with all participants including those who recorded zero frequency for crying or waking. Mean duration scores include only those participants who identified a time period greater than zero.

Table 4.2. Profile of data collected over the seven time points.

Variables	N / %	28 weeks (T1)	33 weeks (T2)	38 weeks (T3)	43 weeks (T4)	48 weeks (T5)	53 weeks (T6)	58 weeks (T7)
Feeding data	N	25	27	27	26	22	29	28
% Breast-fed	%	52	33	30	35	28	17	7
Wake Frequency	N	26	27	28	26	22	29	28
	Mean	1.3	1.4	0	1	0.8	0.6	0.6
Wake Duration (Min)	N	19	19	17	17	9	11	10
	Mean	17.7	18.4	15.9	22.6	26.7	15.3	16.7
Cry Frequency	N	26	26	25	24	20	28	26
	Mean	2.2	2.3	1.8	1.9	2.3	1.6	2.0
Cry Duration (Min)	N	22	23	21	21	18	23	22
	Mean	6.9	7.1	4.9	5.9	4.8	4.2	3.6

3.1.1. Infant feeding: At six months, 52% of infants were breast-fed to some extent, with 17% of infants' fully breast-fed. This is very close to the breast feeding target set by the USA Healthy People 2020 Initiative (US Breastfeeding Committee 2008) of 61% of infants breast-feeding up to six months and 25% exclusive breast-feeding up to six months. It can be seen from Figure 1 that the greatest reduction in breast feeding occurred between 6.5 and eight months and that there was little decline between eight and 11 months suggesting that whilst many mothers ceased breast feeding shortly after six months those who continued, did so for the duration of the first year. Whilst full breast-feeding has ceased by 12 months, a small number (7 %) of mothers continued with some degree of breast-feeding up to the point when data collection ceased at 13.5 months.

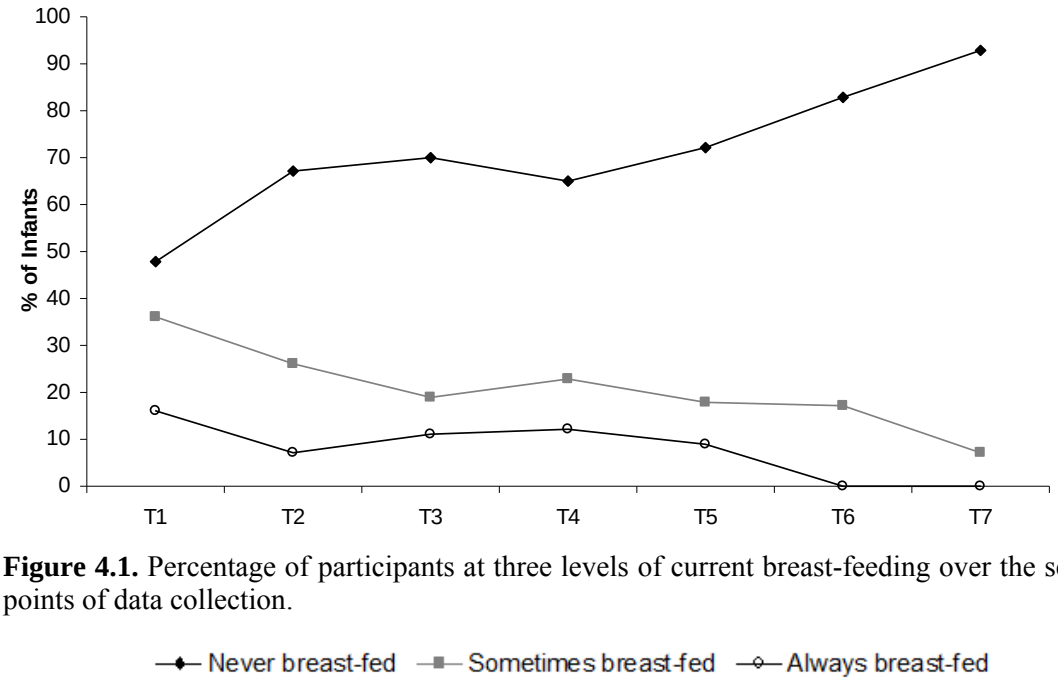

Figure 4.1. Percentage of participants at three levels of current breast-feeding over the seven points of data collection.

3.1.2. Infant Waking: The percentage of infants who slept through the night without waking and signalling increased from 27% at T1 to 68% at T7 (Figure 2). Similar to the findings of Armstrong *et al.* (1994) that 20-30% of infants wake at least once per night at 12 months, our study found 32% of infants waking at 12 months. Moreover, the percentage of infants who woke more than twice per night remained relatively stable, between 10% and 20% from 6.5 to 12 months of age. As can be seen in Table 2, the mean number of infant night awakenings was around 1.3 at T1 and T2 (6.5 months and 7 months) declining to 0.6 at T7 (13.5 months), mainly as a result in the reduction in infants who were waking once per night.

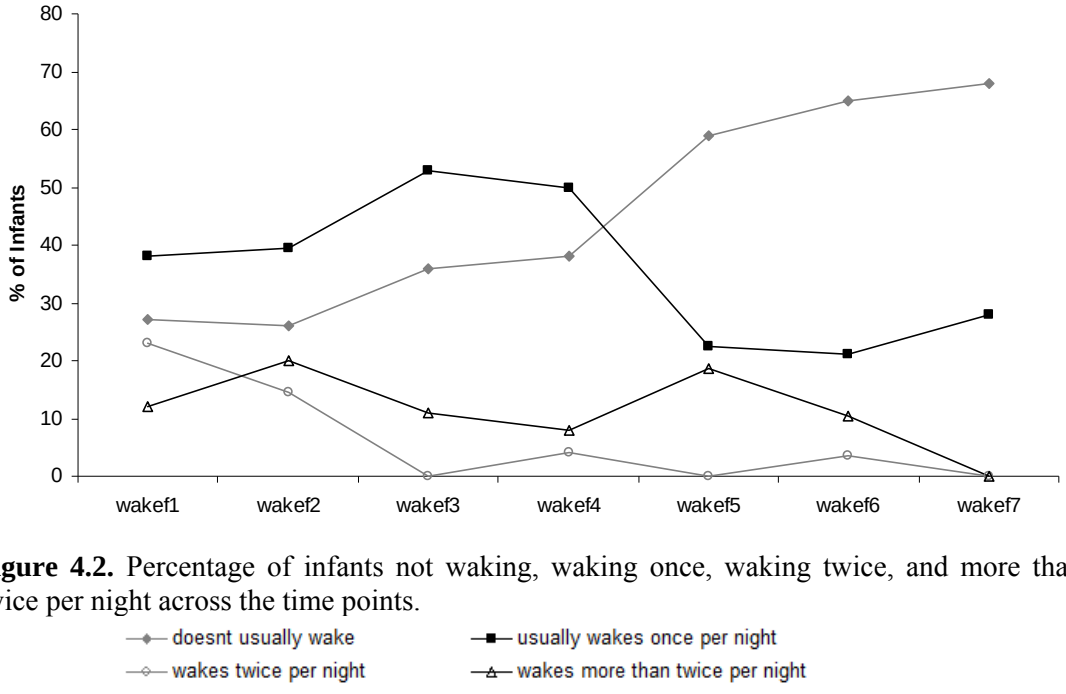

Figure 4.2. Percentage of infants not waking, waking once, waking twice, and more than twice per night across the time points.

Table 2 shows that of those infants who woke, the duration of wakeful events remained relatively stable across the eight month period. The mean reported wake duration was between 15 and 20 minutes, with the exception of an increase in mean wake duration of approximately seven minutes at 10 and 11 months of age. This is

consistent with the findings of Anders and Keener (1985) who reported an increase in wakefulness in the second half of the first year.

Continuity in total wake duration per night (mean wake duration per episode x number of episodes) across the seven time points and with pre-12 week wake duration (collected in phase 1) was investigated by conducting Spearman correlations (see Table 3). Infant night wake duration at any of the seven time points correlated with wake duration at approximately three adjacent time points.

Table 4.3. Trajectory of inter-correlations of infant nightly wake duration across the seven time points and with phase 1 data (pre-12 weeks, phase 1 data).

	Phase 1	T1	T2	T3	T4	T5	T6
T7, r	-0.09	0.07	0.18	-0.20	-0.27	0.08	0.05
T6, r	-0.39	-0.18	0.25	0.02	0.63**	0.90**	
T5, r	-0.19	0.20	0.43*	0.44	0.72**	-	
T4, r	-0.13	0.11	0.66**	0.49*	-		
T3, r	0.13	0.47*	0.70**	-			
T2, r	-0.15	0.65**	-				
T1, r	0.17	-					

* = significant at .05, ** = significant at .01

Interestingly, T7 wake duration and pre-12 week wake duration did not correlate with wake duration from other time points. The lack of a correlation with T7 might simply reflect the instability in night wake routines or of a transition period in infant wake duration at the latter end of the first year as proposed by Scher (in press). Similarly it might be reasonable to assume that a transition or transitions take place at some point between 12 weeks and six months, accounting for the lack of significant correlations between these two periods.

At six and a half months (T1) two different sets of infants were identified, in terms of wake duration (wake duration per episode x number of episodes per night) namely: those who had the higher nightly wake duration and those with lower wake duration. Thirty-five percent reported nightly wake durations of 40 minutes or more with an overall mean of 53 minutes (high), whereas low-waking infants woke for under 30 min (mean of 8.8 minutes) ($t(23) = 9.36$, $p<.01$, $d = 3.9$). As can be seen in Figure 3, by nine months (T3) only two infants (7%) continued to wake for over 40 minutes; one of whom typically woke once per night (approximately 45 min) and the other routinely woke three times per night for shorter durations (3 x 20 min). Our data indicate that even for those with high waking at 6.5 months (T1) most began to settle between nine and 12 months and only three continued to wake at 12 and 13.5 months of age.

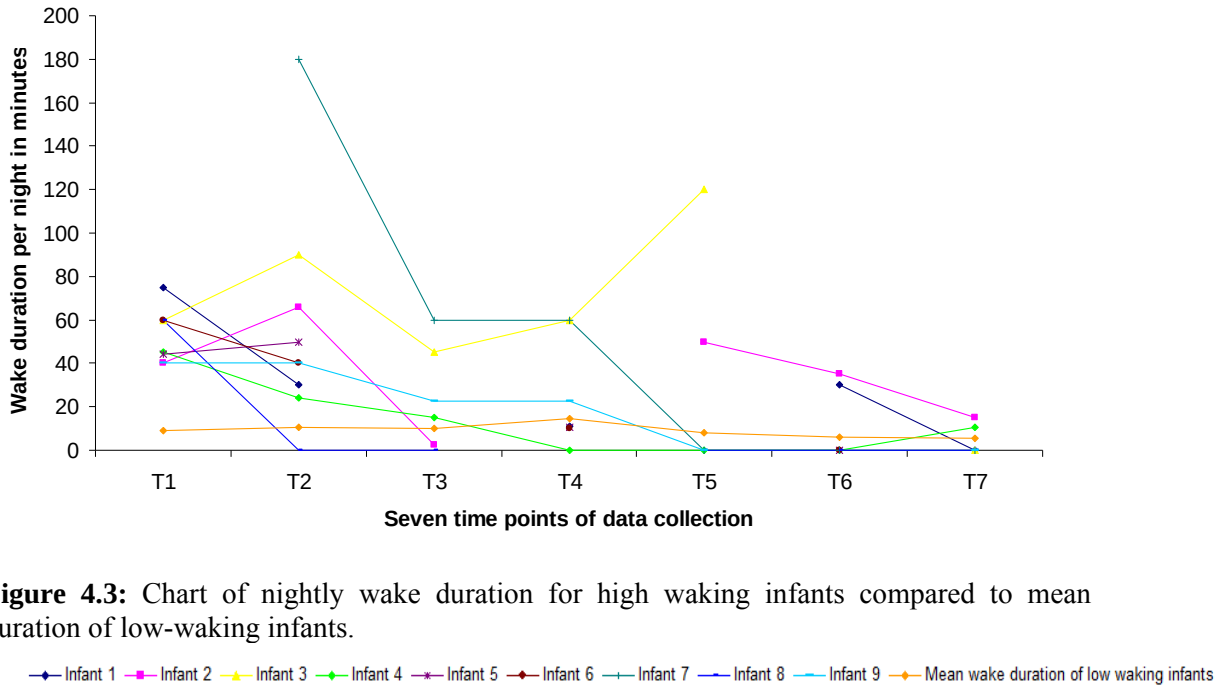

Figure 4.3: Chart of nightly wake duration for high waking infants compared to mean duration of low-waking infants.

In order to investigate individual sleep-wake trajectories for all infants across the study period individual infants were identified as 'sleeping' or 'waking' at each of

the seven time points, individual trajectories are displayed in Figure 4. Infants were then categorised according to the sleep-wake pattern over the seven time points. It can be seen that the first 13 infants (38%) in Figure 4 showed a typical pattern (Category 1, 'expected') beginning with waking at night followed by sleeping through the night thereafter. Category 2 ('variable') represents those infants (n=9, 26%) who showed a mixed pattern of waking and not waking. Category 3 consisted of those infants (n=1, 3%) who showed a 'reverse' pattern, namely; beginning with sleeping through the night and waking thereafter. Infants who continued to wake through the night for the duration of the study (n=4, 12%) constituted the fourth category ('consistent'). Finally the fifth category represented those infants (n=7, 21 %) who began to show signs of sleeping through the night at the last data collection point ('delayed').

Interestingly there was a substantial number (between 8% and 18%) of infants who slept through the night for the first time at each point of data collection. On closer inspection, it can be seen that of those infants waking at 13.5 months four infants (12%) had never slept through the night and five (15%) had a mixed pattern of waking and sleeping and one whose night waking began at 12 months. Our data highlight the intra-individual variability in infant sleep-wake pattern over the latter half of the first year and cautions against too much reliance on cross-sectional data of infant routines.

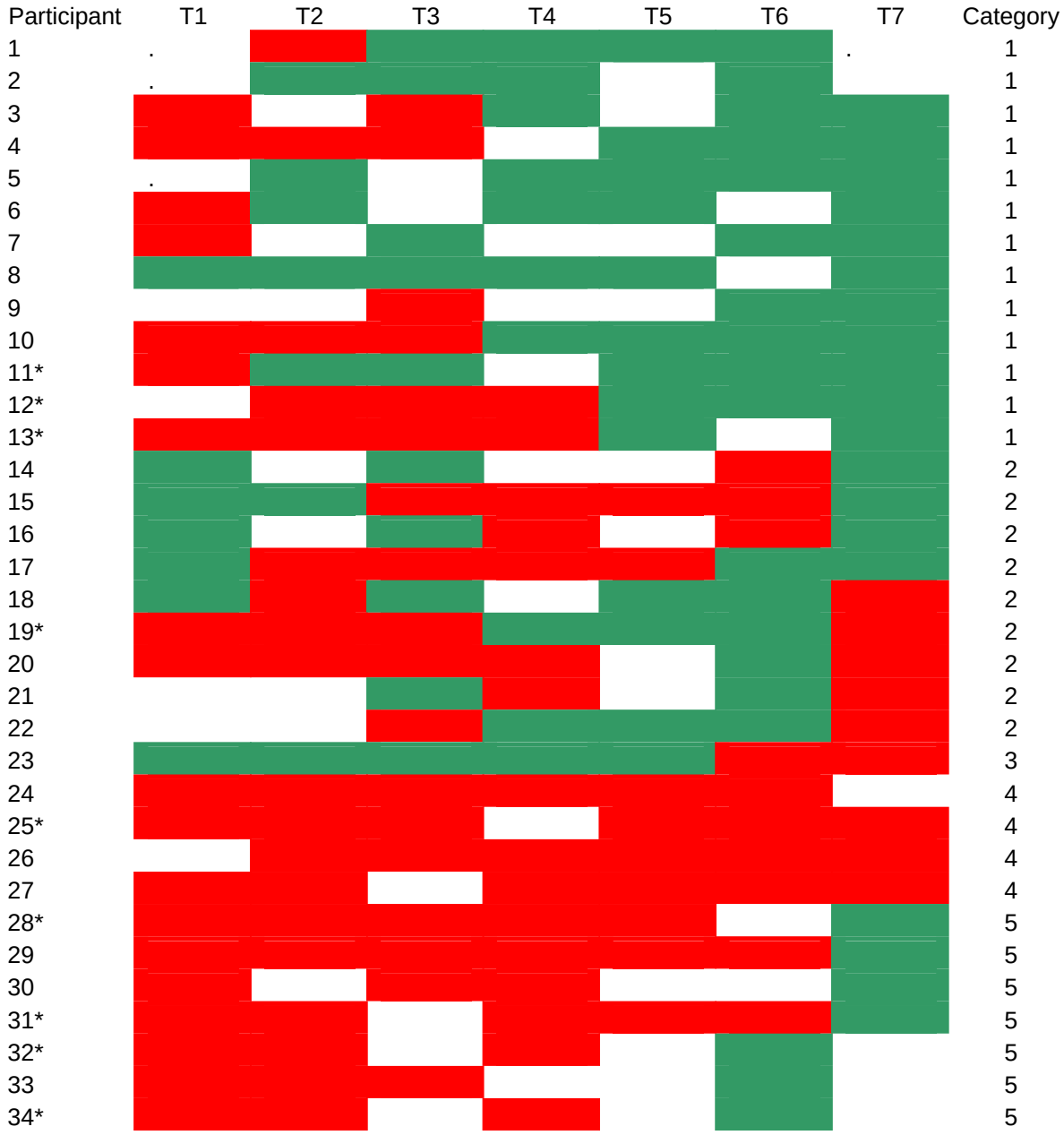

Figure 4.4: Trajectory of waking and sleeping for individual participants from T1 to T7.
Red denotes waking at night and green denotes sleeping through the night.
* Denotes infants with highest nightly wake duration at six months
Wake pattern categories: 1 = expected (38%), 2 = variable (26%), 3 = reverse (3%), 4 = consistent (12%), 5 = delayed (21%).

3.1.2. Infant Crying: Table 2 shows that the mean number of cry episodes reported by mothers remained at around two per day, across the six month period. In contrast, Table 2 shows that the mean cry duration per episode halved across the seven month

study period from a mean of 6.9 minute episodes at 6.5 months (T1), to 3.6 minutes at 13.5 months (T7).

As can be seen in Table 4, total cry duration (cry duration per episode x number of episodes) at any one of the time points was correlated with most other time points indicating a good degree of consistency in cry duration across time. However, only cry duration at T5 was correlated with pre-12 week cry duration; indicating a very weak relation in cry duration between early and late infancy in this community sample of infants.

Table 4.4 Trajectory of inter-correlations, of infant daily cry duration across the seven time points and with phase 1 data (Pre-12 weeks).

	Phase 1	T1	T2	T3	T4	T5	T6	T7
T7, r	0.39	0.17	0.60**	0.49*	0.49*	0.56*	0.77**	.1
T6, r	0.17	0.37	0.51*	0.57**	0.64**	0.32		
T5, r	0.47	0.82**	0.80**	0.69**	0.85**			
T4, r	0.26	0.66**	0.83**	0.73**				
T3, r	0.32	0.62**	0.72**					
T2, r	0.25	0.82**						
T1, r	0.26							

* = significant at .05, ** = significant at .01

At six months, two different sets of infants were identified in terms of crying. Six infants cried for 25 minutes per day or more, while a second group cried substantially less than this with the highest duration for this lower group being 15 minutes and the difference in cry duration between these two groups was significant (t (22) = -7.93, p <.01, d = -3.38). Applying this distinction at six months, namely,

higher than 25 minutes (M = 40 minutes, SD = 16.74) versus lower than 25 minutes (M = 6 minutes, SD = 4.50), it can be seen from Figure 5 that six of the infants (25%) were classified as having high cry duration. Indeed between six and nine months, ten of the infants (30%) were higher criers at some point, and of these all were identified as having high crying at 12 months or over. Conversely of the 23 who were identified as average criers between 6 and 9 months of age, none were identified as high criers at 12 months plus. These findings are similar to those of Armstrong, Quinn and Dadds (1994) who found that between four and nine months 36% of parents reported a parentally defined infant cry problem. Our findings support the use of this more objective measure of 'problematic' crying which seems to also correspond with parental perception.

From examination of the trajectory of infant crying it was possible to categorise infants according to their pattern of crying across the seven time points. Category 1 ('average' criers) referred to those infants who were consistently reported to have average crying levels across all the testing phases (70%). Category two were those infants (15%) who showed a 'variable' pattern of high and average levels of crying and category three those infants (15%) who appeared to transition from high crying in the first two months to the mean level of crying at later points ('transitioning'). No infant was considered to have high levels of crying across the whole period of data collection.

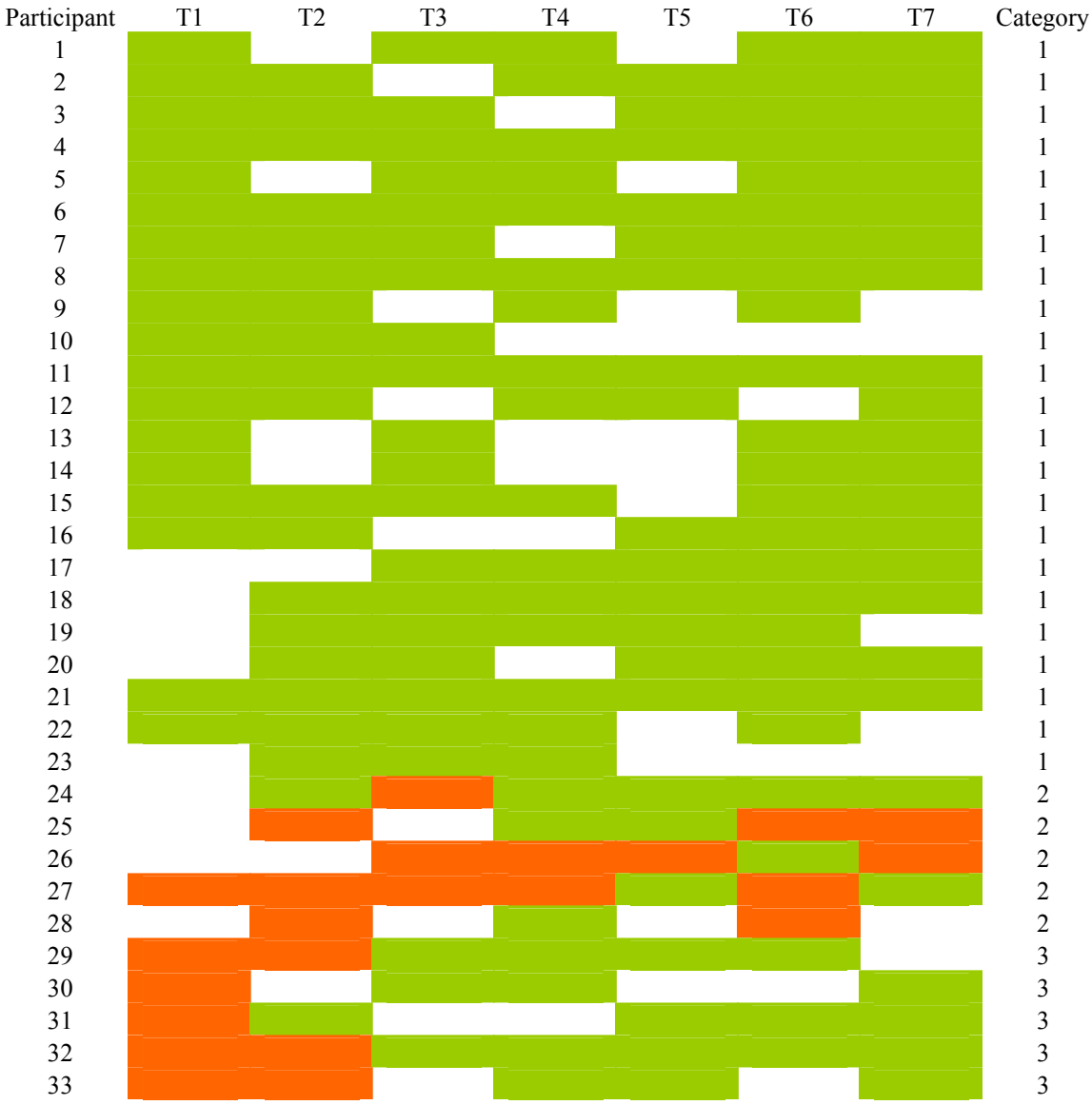

Figure 4.5: Trajectory of high and low cry duration (daily) for each participant from T1 to T7.

Orange denotes high cry duration, green denotes mean cry duration, and blank denotes no data available.
1 = average crier (70%), 2 = variable crier (15%), 3 = transitioning crier (15%).

3.2. Factors related to infant wake and cry routine:

Chi square analyses were conducted to investigate whether wake categories 1, 2, 4 and 5 (wake category 3 was not included as only one infant was classified in this category) and cry categories (1, 2, and 3) were related to an infant's characteristics (some of which were assessed at phase one, i.e. at 12 weeks of age and under), namely: birth-order, sex and feeding method of the infant. No significant differences

were found in wake or cry categories between numbers of males and females per category (χ^2 (3) = 2.42, p = .57), or first-born and subsequent born infants per category (χ^2 (3) = .59, p = 1). Neither was there an effect of feeding-method at 6 months found (χ^2 (6) = 7.76, p = .22). However a significant effect of feeding method during early infancy was found on cry category (χ^2 (2) = 26.65, p = .04). Breast fed infants were significantly more likely to be categorised as 'transitioning' than formula-fed infants. Indeed all infants categorised as transitioning were originally breast-fed infants.

Table 4.5. Percentage of infants' breast-, formula- and mixed-fed by cry category

	Breast-fed	**Formula-fed**	**Mixed-fed**	**Total**
Average	42%	29%	29%	100%
Variable	40%	20%	40%	100%
Transitioning	100%	0%	0%	100%

To examine whether infant temperament (Total EITQ scores) from phase 1 explained current wake and cry categories two ANOVAs were conducted on cry categories 1, 2 and 3 and wake categories 1, 2, 4 and 5. Whilst no significant difference in TEITQ scores was found between wake categories (F (3, 29) = .93, p = .44) a significant difference in TEITQ scores was found between cry categories (F (2, 30) = 4.79, p = .02). Table 6 shows results of post hoc comparisons using the Scheffe multiple comparisons test. Significantly more positive temperament ratings were given to those infants categorised as transitioning criers (M = 24.04; SD = 3.58) than both average criers (M = 28.19; SD = 3.44) and variable criers (M = 30.07; SD = 3.59). No significant difference was revealed between average and variable criers in temperament ratings. However, due to small cell sizes these results need to be interpreted with caution.

Table 4.6 *P* values for Scheffe multiple comparisons of cry categories on infant temperament ratings

Category Comparisons	*p*
Average x Transitioning	.05
Variable x Transitioning	.03
Average x Variable	.55

4. General Discussion.

The purpose of this prospective study was to examine closely the developmental trajectory of infant sleep and cry routines, over the second half of the first year, in a community sample of infants and to determine whether routines are affected by infant characteristics, and whether early cry and sleep patterns are related to later routines. The descriptive analyses clearly illustrated the trajectory of cry and wake routines during later infancy. They specifically highlight, with regard to group means, the similarities and differences in the trajectories of these two infant behaviours, including the relative stability of cry frequency and wake duration in contrast to the evident decline in cry duration and wake frequency over the same period.

Consistent with the findings of Armstrong *et al. (*1994) 32% of infants were found to wake at 12 months of age, and consistent with the findings of Moore and Ucko (1957) 12% of infants never settled between the ages of 6.5 to 12 months. Interestingly, however, whilst there was a decline over the period in the number of infants waking once per night the percentage of infants waking twice or more remained between 10% and 20% throughout. It seems that, as might be expected, infants with higher wake frequencies have greater difficulty in learning to self-settle.

Inferential analyses revealed correlations across time in cry duration and also wake duration indicating a degree of stability over time in these infant routines but with the greater stability in cry duration. Whilst some continuity in waking was found across the study period much greater continuity was found for infant crying generally and was reflected in the continuity of high crying over time.

Wake patterns from early infancy did not show association with wake patterns beyond six months and similarly little correlation was found between pre-12 week crying and later cry patterns. One possible explanation for the lack of an association between early infancy and later routines has been presented by Anders *et al*. (1992). These processes are not well established in the early months and therefore are not reliable predictors of later routines. Alternatively, as suggested above, it is possible that throughout the first year there are specific periods of transition in infant routines which make later routines difficult to predict.

Unique to this study was the analysis of individual trajectories across frequent time samples. Examining individual trajectories revealed greater intra-individual variability in wake routine relative to cry routines from 6.5 months to 13.5 months. More importantly it allowed, for the first time, infants to be categorised according to their night-time wake patterns and cry patterns across the 7 month period.

A frequent enquiry made of new parents is whether the infant is sleeping through the night '*yet'*, and it is widely conceived as a significant milestone. There is an expectation that the infant moves from one developmental stage of waking at night to the next of consolidated sleep, similar to the transition from crawling to walking. Whilst cross-sectional analyses have well established that progressively more infants sleep thorough the night with increasing age, closer examination of individual trajectories reveal that there is much greater instability in infant sleep-wake routines

than group trends reveal. The current study identifies five categories of infant wake pattern namely: expected, variable, reverse, consistent and delayed trajectories. No effect of sex, or birth-order was found for wake categories of the infant nor was there any effect of feeding method (for 6 months or pre-12 weeks feeding) on infant wake category.

With regard to cry pattern, in addition to what might be described as the norm or expected cry pattern, this study identified two other distinct groups, namely those infants who transition from high crying to average crying and those who vary between periods of high crying and periods of average crying. No effect of sex or birth order was found for cry categories. Whilst no effect of feeding method at 6 months was found for overall cry categories, an effect of early breast-feeding (i.e. pre-12 weeks) was found for cry categories. All of the infants who were categorised as having a 'transitioning' pattern of crying were infants who had been breast-fed in early infancy. That is these infants were found to have relatively high levels of crying during the first three time periods (6.5 – 9 months) and to have crying levels within the average range thereafter. It is suggested that breast-fed infants who wake and feed more frequently than formula-fed infants in the early months might take longer to settle during this early weaning period. In addition, a trend was seen for an effect of infant temperament on cry category. Those infants who were rated more negatively on the TEITQ at 3 months tended to be those who, in later infancy, showed a more variable pattern of crying. These results might be a factor of shared method variance as mothers rated their infants on both measures, albeit up to 11 months apart, or may be indicative of early manifestations of a more fussy temperament. Clearly any future research exploring this area of infant development would benefit from the use of more objective measures to validate parental reports.

A limitation of this study was the relatively small sample size and consequently the small number of complete sets of data across the study period, which in turn precluded the use of multivariate analyses such as repeated measures techniques to ascertain significant effects over time. However this unique approach of following, relatively closely, individual trajectories in infant routines during this period of rapid development has been more fruitful than cross-sectional designs in highlighting intra-individual variations in infant cry and wake routines which must be considered in any research on infant routines. The findings also indicate that cry pattern is somewhat more stable over time than infant wake pattern. Our findings support those of Schmid *et al.* (2010) and suggest that the lack of long-term stability indicates that infant wake pattern is more susceptible to parenting styles and routines whereas cry might be more indicative of infant temperament. Future research that adopts this microgenetic approach may offer parents and researchers a clearer insight into infant behaviour, than does the more usual general trend information.

CHAPTER FIVE

MATERNAL EXPERIENCE AND RESPONSE TO INFANT CRYING.

Abstract.

The aim of the study was to examine whether the shorter infant daily sleep for infants of primiparous mothers that was reported by Kaley *et al.* (2012) might be attributed to the shorter response latencies of primiparous mothers to infant cries. The study examined the effects of maternal parity on response latency, attitude to infant rearing and perception of infant cry. Fifty mothers of infants younger than 12 months of age participated in this online study. They listened to two recordings of infant cry stimuli and indicated the point at which they would typically intervene. Participants also completed the Maternal Perception of Infant Crying Scale (Appendix 4.2) and Attitude to Infant Rearing Scale (Appendix 4.2).

No significant effect of parity on response latency was found for the whole sample but an effect that approached significance was found for mothers of younger infants. With multiparous mothers tending to responded more quickly to infant cries than primiparous mothers. For mothers of young infants, those who rated the infant cries more negatively responded significantly more quickly. Maternal age and education were significant predictors of cry perception ratings. Whilst a significant effect of parity was found on maternal attitude to infant rearing, maternal attitude did not predict response latency.

Maternal age and education affected perception of infant crying and in turn perception predicted response latency for mothers of young infants. Maternal experience, was related to more child-centred attitudes, but attitude was not found to affect how quickly a mother responded.

1. Introduction.

In a recent paper by Kaley, Reid and Flynn (2012) an effect of maternal parity on duration of infant sleep was found; whereby infants of primiparous (PP) mothers slept significantly less than infants of multiparous (MP) mothers. In that study it was conjectured that primiparous mothers may be less experienced and less discriminating of infant cries and consequently intervene more immediately than multiparous mothers.

As highlighted in the literature review (section 1.4). Zeifman (2003) found that relatively high levels of empathy and extraversion and low levels of conscientiousness in mothers were associated with more sympathetic descriptions of how the cry stimuli made them feel (such as compassionate and tender) and that cry perceptions and the hypothetical time taken to respond to infant cries could be predicted by parental attitudes to child-rearing. That is, infant-centred attitudes were associated with greater sympathy, shorter response latencies and a greater likelihood of perceiving the cry as urgent. Moreover, Oates (1998) argues that mothers who identify with their infant are likely to value more highly their interactions with their infant.

Frodi, Lamb and Wille (1981) found that mothers of premature infants showed especially high levels of arousal in response to premature infant cries. Similarly Zeskind (1980) found that whilst parents responded differently to 'high risk' cries and 'low risk' cries, this differential responding was not found amongst non-parents, indicating that parental status might also affect responding to infant cries.

Boukydis and Burgess (1982) found a main effect for type of cry and an interaction effect of cry type and parental experience on physiological arousal

measures. Primiparous parents showed highest arousal levels to the cries of infants who had previously been rated as having an 'average' temperament. Boukydis and Burgess suggest that this is because first time parents are learning to discriminate cries whereas multiparous parents have experience in this. In contrast multiparous parents showed higher arousal to the difficult cries. Similarly Stallings, Fleming, Corter, Worthman and Steiner (2001) found that multiparous mothers expressed more sympathy, as measured by an Emotional Response Score (ERS), to pain cry than to a hunger cry whereas primiparous mothers responded with similar levels of sympathy to both cry types, indicating that primiparous mothers were less able to discriminate infant cries. Donate-Bartfield and Passman (1985) found that PP parents gave more frequent and rapid attention to infant crying than MP parents but that no difference was found in aversiveness ratings between the parents.

Del Vecchio (2009) argued that while maternal responsiveness to infant cries is associated with positive developmental outcomes for the child, evidence suggests that responding to every infant cry may hinder the infant's development towards autonomy. Belsky, Rovine and Taylor (1984) found infant fussiness to be associated with higher levels of mother-child interactions. Indeed, responding differentially to distressed and non-distressed cries serves to decrease the number of cry bouts (Hubbard & Ijzendoorn, 1991). Hubbard and Ijzendoorn suggest that mothers, by responding to more severe basic needs cries and not to mild instrumental cries, are shaping their infants' behaviour over time to use other means to elicit social interaction. In contrast Barr (1995) argues that, prior to 3 months of age, infant crying does not reflect infant states and that mothers infer meaning from contextual clues in infant routines at this age and earlier.

Prior research indicates that certain maternal characteristics affect how a mother responds to infant cries such as; extraversion (Zeifman, 2003), parental experience (Boukydis & Burgess, 1982), child-rearing attitudes (Frodi, Bridges & Shonk, 1989) and perception of infant cry (Murray 1979). The purpose of the present study was to examine whether the shorter daily sleep that was reported by Kaley *et al.* (2012) for infants of primiparous mothers might be attributed to the shorter response latencies of primiparous mothers to infant cries and how other maternal and infant characteristics might contribute to this realtion. It was decided that recent experience of infant crying was an essential characteristic of the participants in order for results to be valid. Therefore in contrast to Zeifman's study, where participants included all mothers with offspring under the age of 18 years, the current study only included mothers with recent child-care experience, that is; infants from birth to 12 months of age.

1.1 Aim:

The aim of this study was to investigate both affective and behavioural responses to infant distress signals. We further wished to examine whether an effect of parity in responding to infant crying might explain the shorter overall sleep time for first born infants in study one. It is proposed that birth-order per se is not responsible for shorter infant sleep. Rather, differential maternal responding to infant cry signals between primiparous and multiparous mothers may be a key defining factor in those differences that were found.

1.2. Hypotheses:

i) PP mothers have shorter latency in response to an infant crying than MP mothers.

ii) PP mothers perceive infant cries more negatively than MP mothers.

iii) MP mothers are more likely to express child centred attitudes to child rearing that PP mothers.

2. Method.

2.1. *Ethics.*

Ethical approval was granted in December 2011 by Durham University Psychology Department Ethics Committee. All participants were made aware that they were free to withdraw at any time and that they could choose not to answer all questions on questionnaires. Participants were informed that individuals would not be identifiable in any subsequent reports and were allocated an anonymous identification number. All data were stored in accordance with the Data Protection Act 1998.

2.2. *Participants:*

Fifty mothers aged between 22 and 41 years who were the main carers of their healthy full-term infants aged 12 months and under. As can be seen from Table 1 the sample of mothers was skewed toward those who had completed higher levels of education. The survey was hosted on the university website and participants recruited through posts on social media websites such as ‘Facebook’ and ‘Mumsnet’.

Table 5.1 Demographic data on mothers and infants

		N
Sex of infant	male	28
	female	22
Parity of mother	primiparous	29
	multiparous	21
Age of infant (Total Mean = 6.2 months (SD 3.7))	<5.9 months	24
	> 6 months	26
Maternal Education Level	Further Education	8
	Higher Education	42

2.3. *Design:*

This cross-sectional correlational study explored response latencies to infant crying, perceptions of infant crying, and attitudes to child rearing in both primiparous and multiparous mothers and explored the effects of maternal and infant characteristics on the three dependent variables.

2.4. *Materials:*

This was a web-based survey that participants accessed at their own volition through their own computers. The survey was divided into four parts and took approximately 12 minutes to complete. The survey consisted of the following sections:

1. Two, three minute audio clips of infants 'waking from sleep cry' (i.e. two infants crying with increasing intensity) (Appendix 4.1). These stimuli were recorded in the infants' homes at approximately 4 months of age.
2. Three, 20-second audio clips of vigorous infant crying (Appendix 4.1). These stimuli were sourced from internet video clips of infants of approximately three months of age crying intensely for a minimum of 20 seconds duration. Although no reliability or validity data was available for these, the three clips chosen were specifically selected on the basis of their similar intensities and volumes and all were free from parental intervention

and background noise. Each clip was presented alongside the Maternal Perception of Infant Crying Scale (Appendix 4.2 online survey)

3. Attitude to Infant Rearing Scale (Appendix 4.2 online survey)
4. Background Details Questionnaire (Appendix 4.2 online survey)

2.4.1 *Maternal Perception of Infant Crying Scales* (Zeskind & Lester, 1978). This scale consists of eight dimensions (such as, urgent to non urgent; piercing to not piercing) on which participants rated each cry on a scale from one to seven. The validity of this scale has been supported by the work of Gustafson and Green (1989) who examined the acoustic correlates of adult ratings on this scale and found that acoustic features were highly correlated to parental ratings of cries. This scale was selected to maintain the comparibility of findings between the current study and that of Out *et al*. (2010) and Zeifman (2003)

2.4.2. *Attitude to Infant Rearing Scale* (Zeifman, 2003). This scale attempts to measure the extent to which parents hold infant-centred versus parent-centred views on child care. Participants indicate on an eight point scale the extent to which they agree with eight statements (such as: 'Babies should be fed on a fixed time schedule'). Zeifman reports that this scale, which has face validity, as it poses questions directly about attitude to child rearing, also has a reliability coefficient of .87. This scale was selected in order to replicate Zeifman's study but on mothers with current infant experience.

2.4.3. *Background Details Questionnaire*. This questionnaire was specifically designed to collect mother and infant data such as mothers' and infants' biographic data, pregnancy and delivery details, and childcare experience.

2.5. *Procedure:*

Part 1: Participants were first instructed to set their PC volume control to 40-50 (approximately mid-point) and then listened to two separate examples of infant crying each of 3 minutes duration. Both recordings start with the infant waking from sleep and progress to vigorous crying. For each clip participants were asked to imagine that the crying infant was their baby waking early from a nap. Participants were then asked to indicate, by clicking on a 'now' button, at what point they would be most likely intervene. Prior to starting the survey, participants were advised on how long, approximately, this part would take and informed that the audio clips could not be returned to once they had started listening. This information was given so that they could ensure sufficient time to complete the task prior to commencing the study.

Part 2: Participants listened to three separate 20-second recordings of vigorous infant crying, downloaded from the internet. While listening to each of the cry stimuli participants were asked to rate it on the Maternal Perception of Infant Crying Scales.

Part 3: Participants were asked to complete the 'Attitude to Infant Rearing Scale'. Participants indicated on an eight point scale the extent to which they agreed/disagreed with each of the eight statements. For example: 'Babies should be fed on a fixed time schedule'.

Part 4: Finally, participants completed a Background Details Questionnaire. This collected mothers' biographic data, pregnancy and delivery details, and information on their infant and other childcare experience.

3. Results:

Over a period of three months 50 mothers completed the survey. First, independent *t*-tests were conducted to explore whether consistent differences between multiparous (MP) and primiparous (PP) mothers existed in maternal age, maternal perinatal complications, infant age, infant birth weight, and infant perinatal complications. As can be seen from Tables 2 and 3 no significant differences were found in biographic data between PP and MP mothers. Whilst education level of the sample was skewed toward higher education, chi square analyses confirmed that there was no significant difference between primiparous and multiparous education levels ($\chi^2 = 4.36$, $p = .20$).

Table 5.2. Results of Chi square tests on biographic differences between PP and MP mothers

	df	χ^2	***p***
Parity x Education	3	4.89	.19
Parity x Sex	1	2.54	.15

Table 5.3. Results of t-tests on biographic differences between PP and MP mothers.

	Parity	**Mean**	**SD**	***t***	**df**	***p***
Maternal age (years)	PP	31	4.77	-.42	48	.67
	MP	31.6	4.6			
Maternal complications (number)	PP	1	.78	-.28	32.67	.78
	MP	1.04	1.16			
Infant age (years)	PP	6.34	3.51	.60	48	.55
	MP	5.71	3.91			
Infant complications (number)	PP	0.52	.57	.77	48	.44
	MP	0.38	.67			
Infant birth weight (grams)	PP	3485	654.46	-.48	48	.96
	MP	3494	644.88			

Participants' response latencies (RLs) to the two 'waking from sleep' cry stimuli were recorded in milliseconds. These were rounded to the nearest second for analysis purposes. Consistency in participants' response latency between the two infant audio clips (Cry 1 mean = 46 sec, SD= 32 and Cry 2 mean = 67 sec, SD = 55) was tested by conducting a Spearman correlation (r (50) = .82, p < .001) due to the non-normality of the raw data (Shapiro Wilk (50) = .87, p <.001; Shapiro Wilk (50) = .88, p <.001 respectively). This confirmed that the two 'waking from sleep' cries were responded to similarly by mothers and so response latencies to both infant cries were summed to give an overall RL to infant crying for each participant. As with the separate RLs, the summed RLs were not normally distributed. The data were normalised (Shapiro-Wilk (50) = .96, p = .13) by carrying out a Log transformation as recommended by Tabachnick and Fidell (2007). All subsequent analyses were conducted using transformed RL data. T tests were conducted, initially, to explore potential differences between MP and PP mothers on the three dependent variables (response latency, child-rearing attitude and cry perception). Regression analyses were then carried out to examine which infant and maternal characteristics best predicted the three dependent variables.

3.1. *Effect of maternal parity on response latency*:

The first hypothesis was driven by the findings in the first study that infants of primiparous mothers slept less per 24 hour period than infants of multiparous mothers. It was proposed that PP mothers might not wait so long for their infant to self-settle and therefore intervene more quickly when their infant signalled that they were awake. To test this, an independent t-test was conducted on the effect of parity on response latency but no significant effect was found *(t* (48) = 1.70, p = .10).

However, as the sample of infants in our original study was much younger (mean = 7 weeks) than the sample in the current study (mean = 27 weeks), we considered that the greater childcare experience of the current sample of parents might disguise a parity effect. To examine this data from mothers with young infants only (i.e: birth to 5.9 months, mean = 13 weeks) were analysed in a second *t*-test on this sub-sample (n=26). The results approached significance indicating a possible effect of maternal parity on response latency to infant cries (t (24) = 1.97, p = .06). However contrary to our hypothesis the results indicated that RL was shorter for multiparous mothers (mean = 87.72 sec, SD = 68.78) than primiparous mothers (mean = 131.62 sec, SD = 91.59). MP mothers responded more immediately to 'waking from sleep' infant cries. The results do not support the hypothesis that first-born infants' sleep is shorter because PP mothers responded more quickly to infant cries.

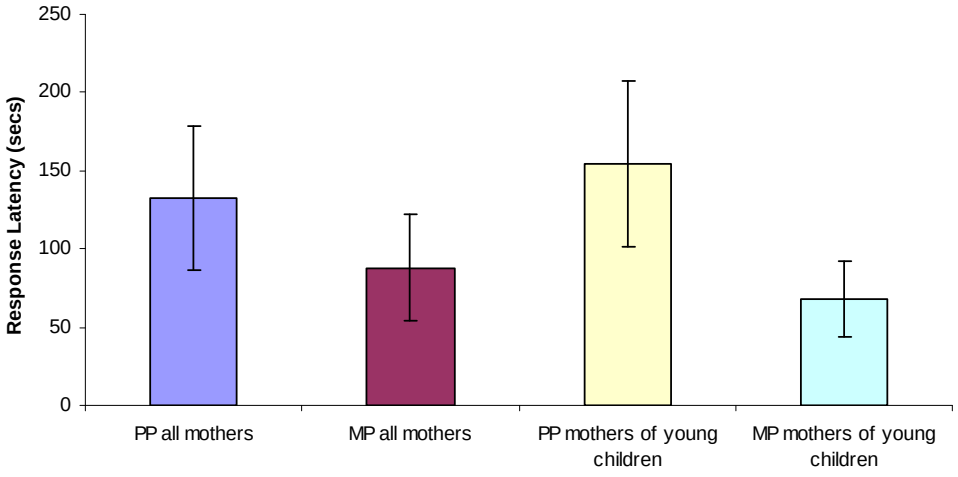

Figure 5.1. Response latencies by parity and sample profile, indicating shorter response latencies of multiparous mothers.

To examine the effect of parity on response latency relative to other maternal and infant characteristics two linear regression analyses were carried out on the sub-

sample of younger infants. The first examined the relation between infant characteristics and response latency. No significant effect of the three infant characteristics, sex, birth weight and perinatal complications was found (R^2 = -.05, F (3, 22) = .61, p = .62). The second regression was calculated to examine the relation between maternal characteristics and response latency. Table 4 shows that, of the four maternal characteristics (parity, perinatal complications, age and education) examined, parity was the only characteristic that approached significance (R^2 = .03, F (4, 21) = 1.21, p = .34). For mothers of young infants there seems to be a trend whereby mothers of subsequent infants tend to respond more promptly (mean = 87 sec, SD = 68.79) to infant cries than mothers of first born infants (mean = 131 sec, SD = 91.59).

Table 5.4. Results of regression analysis for four maternal characteristics as predictor variables of maternal response latency

Maternal Characteristics	***β***	***t***	***p***
Parity	-.39	-1.92	.06
Maternal Complications	.25	1.07	.30
Age	-.11	-.39	.70
Education	.21	.70	.49

3.2. *Effect of maternal parity on perception of infants cry*:

Our second hypothesis suggested that in addition to an effect of parity on response latency, parity differences might also be evident in mothers' perceptions of infant crying. To test this we conducted two independent *t*-tests, first on the whole sample and then on the sub-sample of mothers of young infants. First, because some participants had remarked that responding to 3 similar recordings of infant cries had been confusing we examined the correlation of responses to the three cry recordings. Whilst participant responses to audio recordings A (mean = 30.1, SD = 5.13) and B

(mean = 31.1, SD = 4.05) were correlated, responses to C (mean 24.24, SD = 4.35) did not correlate with either A or B. It was plausible that, due to response fatigue, responses to the third cry recording might well have been less reliable. Consequently only responses to A and B were summed to obtain an overall 'perception of infant cry' measure. The scoring of this measure was such that a higher score indicated a more negative perception of crying. A non significant Shapiro-Wilk test indicated that the perception data were normally distributed (SW (50) = .98, p = .43). The subsequent t –test indicated that there was no significant effect of parity on perception of infant cry and that this was the case for the whole sample of 50 mothers and for the sub-sample of mothers of younger infants (t (24) = .75, p = .46 and t (24) = -1.02, p = .32, respectively). Contrary to our hypothesis no difference between MP and PP mothers was found in perception of infant crying.

Further to finding a null effect of parity on maternal perception of infant cries, the effects of other possible maternal and infant variables were explored by conducting regression analyses. No significant effect of infant variables (i.e. age, infant perinatal complications, sex, or birth weight) was found (R^2 = -.02, F (4, 45) = .74, p = .57). Table 5 shows that of the four maternal characteristics included in a regression analysis (i.e. maternal perinatal complications, age, education, and parity) a significant effect of maternal age and level of education was found (R^2 = .24, F(4, 45) = 4.82, p <.01), whereby higher education level was associated with more negative perceptions of infant cry than lower education level and greater maternal age was associated with less negative perceptions of infant crying than younger maternal age.

Table 5.5. Results of regression analysis for four maternal characteristics as predictor variables of maternal cry perception

Maternal Characteristics	***β***	***t***	***p***
Parity	.01	.10	.92
Maternal Complications	.23	1.66	.10
Age	-.52	-3.27	<.01
Education	.70	4.21	<.001

3.3. *Effect of maternal parity on attitudes to child-care:*

Our third hypothesis proposed that attitudes to child care would be different for PP and MP mothers. Attitude data was found to be normally distributed (SW (50) = .96, p = .08). T-tests were conducted and results showed a significant effect of parity for the whole sample (t (48) = 2.29, p =.03, d = .66) with PP mothers reporting stronger parent-centred attitudes (mean = 27.14, SD = 9.4) than MP mothers (mean = 21.24, SD = 8.4), where higher attitude scores indicated more parent-centred responses, such as, 'Babies should be fed on a fixed time schedule.' This effect was also present for the sub-sample of mothers with younger infants (t (24) = 2.45, p = .02, d = 1). As can be seen in Figure 2 PP mothers (mean = 30.6, SD 6.2) reported significantly greater parent centred attitudes to child-care than MP mothers (mean =23.4, SD=8.9). To examine whether there was an interaction effect of infant age and maternal parity on maternal attitude to child rearing a Two-way ANOVA was conducted (primiparous and multiparous mothers x mothers of younger infants and mothers of older infants). This showed that while there was a significant effect of both maternal parity (F (1, 46) = 5.67, p = .02, eta^2 = .11) and infant age (F (1, 46) = 5.55, p = .02, eta^2 =.11) no interaction effect was present (F (1, 46) = .03, p = .59)

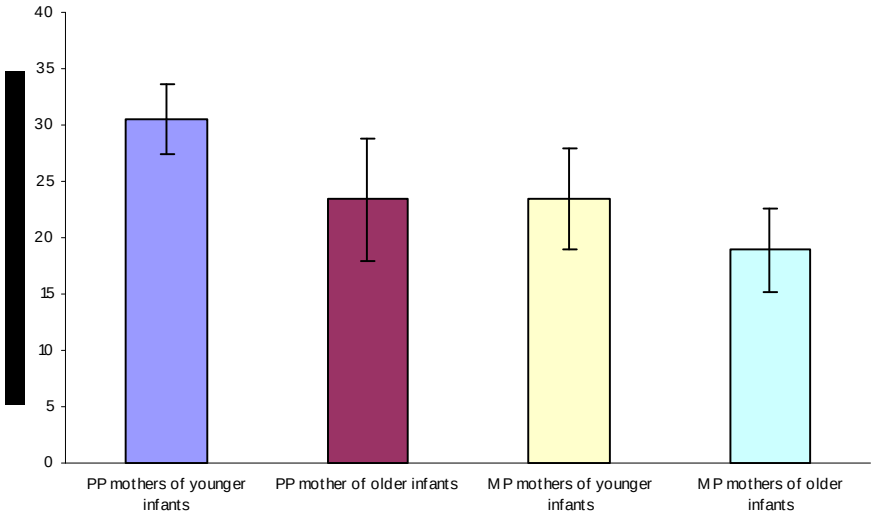

Figure 5.2. Attitude to child care ratings by parity and infant age, indicating lower (more positive) ratings for those mothers with greater child care experience.

To explore the potential effects of other maternal and infant characteristics on attitude to infant rearing responses, two regression analyses were carried out. Of the four maternal characteristics (i.e. maternal perinatal complications, age, education, and parity) entered into the analysis, as shown in Table 6, only parity emerged as a significant factor (R^2 = .08, F (4, 45) = 2.06, p = .10). Mothers of subsequent-born infants gave more positive attitude to child rearing ratings than did mothers of first-born infants.

Table 5.6. Results of regression analysis for four maternal characteristics as predictor variables of attitude to child rearing.

Maternal Characteristics	***β***	***t***	***p***
Parity	-.31	-2.19	.03
Maternal Complications	.22	1.5	.14
Age	.04	.21	.83
Education	.13	.70	.49

As shown in Table 7 of the four infant characteristics (i.e. age, infant perinatal complications, sex, and birth weight) entered into the regression analysis, only age of the infant significantly predicted maternal attitude (R^2 = .12 F (4, 45) = 2.64 p = .05). with mothers of older infants tending to give more positive perception of cry ratings than mothers of younger infants.

Table 5.7. Results of regression analysis for four infant characteristics as predictor variables of maternal cry perception

Infant Characteristics	***β***	***t***	***p***
Sex	.186	1.37	.18
Age	-.33	-2.41	.02
Infant Complications	.04	.27	.79
Birth weight	-.24	-1.74	.09

3.4. *Predicting responses latency from infant age, maternal attitude, maternal perception and parity*:

In order to further explore the relation of attitude to child-care, and perception of crying to RL, two regression analyses were conducted using RL as the dependent variable. The first was conducted on the whole sample. The second was undertaken for the sub-sample of mothers with young infants. For the whole sample none of the independent variables significantly predicted mothers' RL (R^2 = -.008, F (4, 45), = .90, p = .47) However for mothers of young infants RL was significantly predicted by maternal perception of crying only (R^2 = -.15, F (1, 24) = 5.45, p = .03). As might be expected more negative perceptions of crying were related to shorter response latencies.

4. Discussion.

The primary aim of this investigation was to examine whether primiparous mothers responded more quickly to infant cries than multiparous mothers and, if so, whether this might be accounted for by differences in perception of infant cry or by differences in attitude to child rearing. No effect of parity was found when using the whole sample of 50 mothers with infants between birth and 12 months. However as this sample was older than the sample in study one, mothers were split into two groups namely; younger infants (birth -5.9 months) and older infants (6-12 months). The effect of parity on response latency for the sub-sample of mothers parenting younger infants approached significance. However, contrary to the hypothesis PP mothers tended to have longer response latencies than MP mothers. Mothers with less experience, that is first-time mothers with younger infants, responded less immediately than mothers with more child care experience.

The two cry samples used in this study were recorded from young infants (under 4 months) when waking from sleep; that is, progressing from quiet awake to intense crying. It is possible that the cry stimuli used in this study were relatively arousing in which case, consistent with Boukydis and Burgess (1982), MP mothers would be expected to have shorter response latencies. Future research might investigate this further by using cry stimuli of different intensities. The tendency of MP mothers to respond quicker than PP mothers might also be explained by Wood and Gustafson's (2001) finding that response latency can be affected by contextual information. Wood and Gustafson found that participants who were informed that the infant needed sleep waited longer to respond. In the current study all mothers were provided with contextual information for the infant cry stimuli (i.e: '…your baby

waking early from a nap'). Perhaps less experienced, PP mothers, gave more importance to this contextual information and if so they might delay their response longer than more experienced MP mothers who might be more inclined to disregard contextual information and prioritise their perceived needs of the infant. Such an explanation would also be consistent with the tendency for MP mothers to exhibit more child-centred attitudes than PP mothers.

The possible effect of other infant and maternal characteristics on response latency was then explored. No effect of four infant characteristics on response latency was found and of the four maternal characteristics explored, only parity approached significance. So whilst parity might affect response latency for mothers of younger infants, the direction of the effect was not as we had hypothesised. On the basis of these results, it would appear that greater maternal experience is related to more immediate responding to infant crying. However, caution is needed in generalising the findings of this study as unfamiliar infant cries were used as stimuli and possibly mothers respond differently to own and unfamiliar infant cries particularly in a more naturalistic setting (Weisenfeld, Zander-Malatesta & DeLoach, 1981).

To test the second hypothesis we examined whether maternal parity affected maternal perception of infant crying. The hypothesis predicted that an effect of parity would be found on mothers' perceptions of infant cries. Participants responded to three short audio recordings of vigorous infant crying. However, feedback from participants, which was volunteered by some participants through the social networking sites, suggested that response fatigue might have affected the results especially with regard to the third and final cry stimulus. Consequently the analyses only included participant responses to the first two cry stimuli. With regard to how positively or negatively the mothers rated the audio-clips of infant cries, no significant

effect of parity was found either for the whole sample or for the 'younger' sub-sample. In this regard the results support the findings of Donate-Bartfield and Passman (1985) and Zeifman (2003) who found no difference in aversiveness ratings between PP and MP parents. The factors which significantly predicted maternal perception of infant crying were maternal age and education. Older mothers and mothers less highly educated tending to give more positive cry perception ratings. Whilst these maternal characteristics were not found to affect response latency directly it might be that they are mediated by maternal perception which, in turn, is related to response latency.

However as this study used different cry stimuli in the response latency task (i.e., two waking from sleep stimuli) and cry perception task (i.e., two short vigorous cry stimuli) it was not possible with the current data to examine whether the 'waking from sleep' cries were perceived as more urgent or in greater need of intervention by the MP mothers. Future research that assesses mothers' perceptions after they have signalled their response latency to the same cry stimulus might better clarify the relation between response latency and perception of infant cry. Nevertheless the findings of the current study suggest that whilst maternal parity does not affect perception of infant cries, cry perception is the main predictor of maternal response times. Furthermore, child care experience, whether it is through previous children or older infants, seems to elicit more child-centred attitudes.

In contrast to our findings thus far, and consistent with our third hypothesis, a significant effect of parity was found on maternal attitude to child-care both for the whole sample and for the sub-sample. Of all maternal and infant characteristics examined maternal parity and infant age were the only predictors of maternal attitude. Our results suggest that MP mothers are significantly more child-centred in their

attitudes than PP mothers and that this was true irrespective of the age of their infant, but that more child-centred responses also increased with age of the infant. One possible explanation is that child-centred attitudes increase with growing child-care experience. Primiparous mothers of young infants have arguably the least child-care experience and in the current sample they held the most parent-centred attitudes. Conversely mothers with the greatest experience (i.e. the whole sample of multiparous mothers) held the most child-centred attitudes. Indeed the findings that attitude is predicted by parity and infant age lends further support to this hypothesis. Future research is needed to explore this relationship in greater detail. A study following women's attitudes before and after childbirth through to a second or third child would clarify whether parity influences maternal attitudes to child-care or whether those mothers with child-centred attitudes are more likely to have more children. Moreover the finding highlights the need for future research in this field to control for maternal parity.

Finally, when maternal attitude and perception of crying were jointly tested as predictor variables for response latency in a stepwise regression neither significantly predicted RL when data from the whole sample were analysed. When data from the sub-sample of mothers of younger infants were analysed, maternal perception of crying was the only variable entered as a significant predictor of response latency, indicating that response latency is best predicted by how negatively the infants' cry is perceived by mothers of young infants. The current findings support those of Wood and Gustafson (2001) and Zeifman (2003) who found that more negative perceptions of infant crying predicted shorter response latencies. However whilst the current results indicate that mothers with more child-rearing experience have more child-centred attitudes, maternal attitude was not found to be related to response latency.

This study supports the contention that maternal characteristics affect responses to infant crying. The online nature of this study has both its strengths and limitations. As might be expected in an online survey (Sadeh *et al*., 2009) the participant sample was skewed towards higher education levels than would be expected in a random sample. A sample with a more normally distributed level of education might have given rise to greater variability in dependent variable measures. Second, as participants were required to assess each of three twenty-second cries on eight dimensions, it is possible that the duration of the clip was not sufficient for participants to process and rate similar cries accurately. Future research might therefore benefit from allowing participants longer exposure to the cry stimulus and from ensuring a standardized cry frequency across the cry stimuli. Strengths of this method included the greater sense of anonymity experienced by participants in online surveys and therefore the potential reduction in response biases (Sadeh*, et al.,* 2009); participant convenience, and being able to reach a more geographically dispersed sample. This method of data collection also has a number of advantages over naturalistic studies. First, cry stimuli were held relatively constant across all mothers, albeit subject to speaker quality and ambient noise, thereby avoiding confounding of the results with variable infant cries. Second, as response latencies of MP mothers in naturalistic settings might be affected by the needs of other children in the home when an infant cries spontaneously, in the current more controlled setting the effects of the presence of other children was lessened particularly as participants were advised of the approximate time taken to complete the survey and that the cry stimuli could not be returned to, thus ensuring participants completed the survey when it was most convenient.

4.1. *Conclusion.*

The results do not support the original hypothesis that first-time mothers respond more quickly to the cries of a waking infant. For mothers of younger infants response latency was predicted by perception of infant cries and this in turn was predicted by maternal age and education but not maternal parity. However a significant effect of parity was found across all mothers on maternal attitude to child-rearing. It is suggested that perhaps different factors affect response latency at different stages in the infant's development and that potential parity effects need to be controlled for in future research.

CHAPTER SIX

THE EFFECTIVENESS OF A SETTLE-SLING IN HELPING TO SOOTHE AND SETTLE CRYING INFANTS.

Abstract.

Many types of interventions have been tried for excessive infant crying including, psychological, behavioural, dietary and pharmacological, but no single technique has been found to be reliably effective. The aim of this study was to investigate the effectiveness of a newly designed Settle-sling in soothing infant crying. Sixty- nine mother-infant dyads participated and were allocated to one of three conditions, namely: Settle-sling, Control-sling and No-sling conditions. Mothers kept a record of the frequency and duration of infant crying for a minimum of 3 days during a three week period, which comprised a baseline week, an intervention week and a post intervention week. During the intervention week mothers recorded ease of settling in the diary (Appendix 5.2) and were asked to use the provided sling if required when crying was excessive. A mixed model ANOVA indicated a significant effect of week on cry duration with crying reducing for participants in all conditions over the three weeks. However no significant effect of condition was found. Similarly a one-way ANOVA indicated that there was no significant difference in settle-time between the infants in the three conditions. Whilst these results do not support the hypothesis that infants in the settle-sling would settle more rapidly and cry less than infants in the other two conditions, improved sling design and increased number of participants in the Settle-sling condition is recommended before definitive conclusions can be made.

1. Introduction.

> "The unpleasantness of excessive infant crying is obvious enough to require little documentation. Parents experience much fear, anger and guilt and find child rearing fatiguing and not as rewarding as they had hoped" (Carey, 1990, p 335).

Reports on the incidence of excessive infant crying vary between 16-26% (Garrison & Christakis, 2000) and 5-40% (Lucassen *et al.,* 2001). The studies Lucassen *et al.* considered being the most robust in design obtained occurrences rates of 5% (Canivet., Hagander, Jakobsson, & Lanke, 1996) and 19% (Hogdal *et al.,* 1991), respectively. In practice, Lindberg (2000) reports that excessive unexplained crying is the most frequent parental concern in a baby's first year and Lucas and St James-Roberts (1998) estimated that one in six families with a child under 3 months approach a medical practitioner with concerns about excessive infant crying. Indeed, the annual financial cost, to the NHS, of infant crying and sleep problems in the first 12 weeks has been estimated to be around £65 million. (Morris, St James-Roberts, Sleep & Gillham, 2001)

The implications of having an excessively crying infant are significant. Reijneveld, van der Wal, Brugman, Sing and Verloove-Vanhorick (2004) found that 5.6% of parents in the Netherlands reported slapping, shaking or smothering their infant to stop their crying. Barr, Paterson, MacMartin, Lehtonen and Young (2005) reported that evidence gathered from perpetrators and epidemiological studies indicate that excessive crying is a trigger event for shaken baby syndrome, abuse or neglect. This is further supported by the work of Lee, Barr, Catherine and Wicks

(2007) who found that the incidence curve of shaken baby syndrome is similar to that of the normal crying curve.

Despite the size of the problem Wikander (1995) has argued that the clinical approach is dominated by trial and error because providers of paediatric health care do not appear to operate from a shared belief in the aetiology or treatment of excessive crying. Such conflicting information has led to confusing advice for parents, which in turn compounds the problems associated with dealing with an excessively crying baby. This view is shared by Barr (1993) who argued that because of its benign nature and spontaneous recovery excessive crying, also known as infant colic, is often seen as part of normal development, thereby deflecting attention from managing the serious effects of crying behaviour on the family. Keefe and Froese-Fretz (1991) and Barr, St James-Roberts and Keefe (2001) argue that parental distress is in fact exacerbated by this lack of conclusive information on effective intervention. It is clear that a parent's ability to sooth their infant's crying is important for both the child's and parents' wellbeing yet there is no agreed upon reliably effective intervention.

Treatments that have been investigated fall into six categories: (i) dietary interventions, such as the removal of cow's milk protein, (ii) natural remedies, such as herbal tea and sucrose solution; (iii) behavioural interventions, such as massage and rocking, (iv) behavioural/psychological interventions involving the counselling and advising of parents and (vi) pharmacological treatments, such as the use of Simethicone (Infacol) or Dicyclomine. In a review of intervention studies Garrison and Christakis (2000) found that dietary interventions such as the use of hypoallergenic milk formula or dairy free diets for breast feeding mothers can be effective on some occasions for some children. Similarly mixed results were found by

Stevens, Yamada and Ohlsson (2004) who performed a meta-analysis of sucrose interventions as a means of pain relief. With regard to pharmacological interventions, Ciftci and Arikan (2007) reported that of the three random control trials in their review, there, appears to be no drug that alleviates excessive crying without potentially dangerous side-effects.

The effectiveness of psychological-behavioural interventions has been investigated by Wolke, Gray and Meyer (1994) and Parkin, Schwartz and Manuel (1993). They examined the effectiveness of parent behavioural counselling in alleviating excessive infant crying compared to non-specific reassurance. Whilst Parkin *et al*. found no significant difference between the two methods, Wolke, *et al.* found a significantly greater reduction in cry frequency and cry duration following this behavioural counselling than following an empathy intervention or no treatment control.

Single behavioural interventions that have been studied are many and varied. As mentioned in the literature review (section 1.4) some have focussed on chiropractic and massage interventions whilst others have examined behaviours more naturally adopted by parents such as rocking and supplementary carrying (e.g. Ciftci & Arikan, 2007 and Hunziker & Barr, 1986). More recently, Lohaus Keller and Voelkers (2001) investigated the effectiveness of increased eye contact. They found that during the first 12 weeks eye contact is related to a decrease in cry duration. Research investigating increasing positive interaction found that gentle touch can reinforce and maintain high rates of infant eye contact responses and smiles during face to face interactions (Peláez-Nogueras *et al*., 1996).

It is clear that studies investigating the effectiveness of single behavioural techniques have not found any single technique to be effective. This study aims to

investigate the effectiveness of a newly developed Settle-sling in comforting and soothing crying infants. The sling allows the infant to lie on their back on an inclined plane, with the abdomen gently extended (Figure 1). It was designed as a means of combining a number of recommended behavioural techniques for soothing infant crying. That is, it allows the infant to be held and gently rocked (Cifti & Arikan, 2007; Hunziker & Barr, 1986) whilst allowing the parent to maintain eye contact (Lohaus *et al.,* 2001) and stroke the infant (Pelaez-Nogueras *et al*., 1996). It is anticipated that the use of the sling also reduces the incidence of infants becoming over stimulated from multiple changes of position (Wolke *et al*., 1994).

Infants in the Settle-sling would therefore be expected to be soothed and settle more quickly than infants soothed using more traditional methods. This would be evidenced by a reduction in cry duration from baseline week to intervention for the Settle-sling infants and by the Settle-sling infants to settle more quickly during the intervention week than infants in either of the two control conditions. In one control condition mothers were permitted a free choice of soothing technique and in the other mothers were given a commercially available infant sling. A control sling was included in order to control for a reduction in infant crying occurring as a result of proximity to the mother and any advantage afforded by the use of a sling in extended periods of carrying the infant.

2. Method.

2.1. *Ethics*.

Ethical approval was granted in December 2008 by Durham University Psychology Department Ethics Committee. As reported in Chapter Two (section 2.1)

2.2. *Participants:*

Sixty-five mother-child dyads with a mean age of 49 days were recruited to the study. 74% were recruited from children's centres in two local authority areas in the North East of England, 13% by word of mouth, 9% from other community groups and 4% through a media campaign. Inclusion criteria were that the child was aged between 4 and 9 weeks at the point of recruitment and born between 37 and 42 weeks gestation. Both bottle and breast fed infants were included and those of both smoking and non-smoking parents. Exclusion criteria were: Complications during birth or pregnancy which had raised medical concerns for the baby's welfare, congenital conditions and gastro-intestinal problems for which medication was being prescribed.

Approximately 50% of visits to children's centres yielded a mother-child dyad, of the appropriate age, interested in taking part. Mid-way into the study the retention rate was 59% with the majority of participant withdrawal happening during the first week of diary completion. In an assessed sample of those who withdrew, the mean infant age was 44 days, 37% of whom were male.

2.3. *Design:*

Participants were allocated to one of three conditions namely: A Settle-sling condition; a control-sling condition where participants used a commercially available travel sling – a 'Baby Bjorn' Baby Carrier Active; or a No-sling condition. For the purposes of ensuring that equal numbers of infants with negative/positive affect were allocated across the three conditions participants completed the Early Infancy Temperament Questionnaire during baseline week and were allocated to a condition accordingly. In order to remain sensitive to the added pressure in a family's life,

parents were permitted a degree of choice with respect to which condition they were allocated. That is mothers were advised as to which condition they had been allocated but were permitted to change this if they expressed a strong resistance to the allocated condition. Infant sleeping, feeding and crying routines were recorded by the parent in a diary for a minimum of three days per week for three weeks. An ABA design was adopted whereby the first week of diary data constituted a baseline week, the second week constituted the intervention week, during which comforting techniques were assessed and the third week was a post intervention week to ensure that any reduction in crying in the second week was not a function of maturation.

2.4. *Materials:*

2.4.1 Slings: The newly developed Settle-sling (Figure 1) is a harness sling suitable for babies between 7lbs 11ounces and 13lbs 3 ounces. It is constructed in a way that holds the baby at a 45 degree angle away from the adult to facilitate parent eye contact and stroking, and to allow the infant's abdomen to lie straighter and more extended than in commercially available slings. Designed specifically for comforting a distressed baby, the weight distribution of the infant encourages a gentle swinging movement of the adult. Unlike other slings this sling is intended for indoor use only.

The slings selected as control-slings were commercially available 'Baby Bjorn' slings, suitable for babies of 8lbs to 26lbs (Appendix 5.1). These too are harness slings but hold the baby in an upright position in contact with the adult's body. The infant's abdomen is not extended, eye contact is not possible and there is close proximity to the parent.

Figure 6.1. Settle-sling in use showing, infant lying on back in an upright position with extended abdomen and allowing for maternal eye-contact and gentle swinging motion.

2.4.2 Diaries: Much of the previous research into cry and sleep patterns has used parental diaries (Barr *et al*. 1988; Lehtonen *et al.,* 1994; St James-Roberts, 1995; Pauli-Pott *et al*., 2000 and Arikan *et al*., 2008) as retrospective questionnaires and subjective views are considered to be "more prone to distortions due to current emotional distress than behaviour diaries" (Wurmser *et al.*, 2006 p 347). To address the specific requirements of the study three diaries were developed, one for each of the three weeks of participation. Diaries (Appendix 1.1) were made-up of a page for each day of record keeping, with each day to be recorded from midnight to midnight. Each page was divided into four main sections namely; feeding, day time naps, night waking and crying. Each of these sections was divided into sub-sections for recording the time and duration of each behavioural event. In addition the section on crying allowed for the recording of how the baby was comforted. Space was also allocated for participants to note anything out of the ordinary, e.g., if the infant did not feed as normal or for more general information such as illness/vaccinations etc. Written diary

instructions explained the type of information that was required in each of the four sections and a day's example page was provided.

The above diary format was used for all three weeks; however, for the intervention week (diary 2), an additional page each day was included for recording the effectiveness of the method of comforting. For the sling conditions this was organised so that the methods of comforting, that were used before, during and, where necessary, after the sling, could be recorded. In addition a 5 point rating scale on how long it took the infant to settled was provided. The scale ranged from within 15 minutes to more than 1 hour/removed from the sling. For the No-sling condition comparable but non-specific questions were asked about comforting methods such as 'What method did you use to settle your baby?' and a similar 5 point settle time scale provided (Appendix 5.2).

2.4.3 Temperament Questionnaire: The Early Infancy Temperament Questionnaire (EITQ) (Appendices 1.2 and 1.3), developed by Medoff-Cooper, Carey and Devitt (1993) was used to assess infant temperament during phase one of the study (as detailed in Chapter Two), The EITQ was considered to be the most appropriate temperament questionnaire for this study as it was designed specifically for infants from four weeks to four months of age. Medoff-Cooper *et al,* (1993). indicated that the 'distractibility' and 'mood' dimensions are the key dimensions of a mother's overall impression of infant behaviour. The mood dimension assesses the frequency of the infant showing pleasure/displeasure and the distractibility dimension how easily the infant can be soothed. These two dimensions were therefore identified as those most reflecting an infants crying behaviour and therefore used for the purposes of allocating an equal balance of infants with positive and negative affect to the three conditions.

2.4 *Procedure:*

Those parents who were interested in participating completed a consent form (Appendix 1.5) and a personal details form (Appendix 1.6). Participants were then shown the first diary and given standardised verbal instructions on how to complete it (Appendix 1.7). They were then shown the EITQ and again standardised instructions were given. Participants were asked to complete a minimum of 3-4 days of the diary record over the following week and to complete the EITQ in their own time and to return it with the diary. Each participant was allocated an ID number and this became the only means of identification on diaries and temperament questionnaires.

At the second contact, one week later, the mood and distractibility dimensions of the EITQ were scored so that the participant could be allocated to a condition. Participants were then asked if they were happy to be allocated to their nominated condition. Where a participant was allocated to a 'Settle-sling' or 'carry sling' condition, the researcher demonstrated the sling and adjusted it to fit the participant. The participant then practised how to position and remove the baby safely. An information leaflet on how to use the sling was given and safety issues highlighted. Participants were then given diary 2 and shown how to record the details of sling use. Participants were asked to record a minimum of 3 uses.

Participants in the No-sling control condition were asked to nominate their own preferred method of comforting for the second week and to record details of the effectiveness of their preferred method on the 'comforting' pages of diary 2. As in the sling groups, participants were asked to make a minimum of 3 recordings.

At the end of the second week the diary and slings were collected and participants given the third diary which, like diary one, was solely a record of infant routines. At the end of the third and final week of data recording the diary was

collected and the participants debriefed as to the purpose of the study and given a small token of thanks.

3. Results.

Criteria for inclusion into the analysis were that a participant had completed a minimum of 3 days of diary record each week, from which mean daily cry frequency, and mean daily cry duration were calculated for each of the 3 weeks. From diary 2, a minimum of three episodes of sling use/comforting data were used to calculate a mean settle time rating for each participant. Finally mood and distractibility scores were calculated for each participant from the EITQ (Table 1).

Table 6.1. Number of participants with complete data for cry, temperament and settle-time measures by condition.

Data	**NS***	**CS***	**SS***
Cry (frequency and duration.)	24	18	14
Mood and Distractibility	29	22	14
Settle Time Rating	19	13	12

* NS = No-sling, CS = Control-sling, SS = sleep-sling.

Table 2 below shows baseline parameters for participants in the three conditions. It can be seen that there were no significant differences across the three conditions in mean age, (F (2, 59) = .23, p = .79). Similarly Chi square analyses indicate that there were no significant differences between the conditions in infant sex, parity, type of feeding or parental smoking. Table 2 also shows that the numbers of infants with positive/negative affect were equally distributed across the three

conditions. That is, there was no significant difference in the affect of infants across the three conditions (F (2, 60) = 1.13, p = .33), or levels of distractibility across the three conditions (F (2, 60) = .39, p = .68). According to mother's ratings, at baseline therefore, infants showed similar levels of positive/negative affect and in how easily distracted or soothed they were once upset.

Table 6.2: Infant baseline parameters by condition.

	NS	**CS**	**SS**	**F/ Chi**
Mean Age in Days	49.4 (11.2)	50.5 (14.1)	47 (11.0)	.23
Sex (% M)	52	70	43	2.8
Parity (% 1st born)	45	65	64	2.5
Feed Type (% Brst, Formula, Mix)	48, 41, 10	50, 20, 30	50, 21, 29	5.02
Parent Smokers %	10.3	15	14.3	.27
Mean Mood Score	2.8 (0.8)	2.8 (0.8)	3.1 (0.8)	1.13
Mean Distractibility Score	2.5 (0.8)	2.6 (0.8)	2.7 (0.6)	.39
Mean Cry Frequency	3.9 (1.5)	3.5 (1.1)	4.4 (1.6)	1.8
Mean Cry Duration (min)	35.9 (22.3)	40.17 (27.8)	70.35 (43)	6.3**

Standard deviation in parentheses

From the diary records the frequency and duration of crying at baseline for the three conditions were calculated. Table 2 shows that the mean frequency of crying episodes per day was similar for all three conditions. The ANOVA confirms that there were no significant differences in frequency of crying across the three conditions at the baseline assessment (F (2, 53) = 1.76, p = .18). With regard to mean duration of crying however, this was higher in those allocated to the Settle-sling (SS) condition than both other conditions and almost twice that of the No-sling (NS) infants. Indeed the ANOVA reveals a significant difference in baseline duration of crying between the three groups (F (2, 53) = 5.1, p = .01). Scheffe multiple comparisons revealed that

the significant difference lay between the Settle-sling and the No-sling conditions (p = .01). Whilst the mean duration of crying in the Settle-sling group was also higher than that of the Control-sling (CS) group, this difference was not significant (p = .10).

A mixed model ANOVA was then used to examine differences between the three conditions in cry duration across the three weeks (NS/CS/SS x week 1/week 2/week 3). Due to the relatively small number of participants with eligible data in the SS condition the following results need to be interpreted with caution.

Table 6.3. Mean cry duration in minutes for infants in the three conditions across three weeks of participation.

	n	**Week 1**	**Week 2**	**Week 3**
NS	22	33.9 (20.3)	40.2 (27.3)	27.8 (18.5)
CS	17	41.6 (29.5)	37.4 (23.3)	34.5 (19.9)
SS	8	68 (46)	55.5 (40)	42 (32.6)

Standard deviation in parentheses

The results indicate a significant effect of week (F (2, 43) = 6.80, p < .01) but no significant effect of condition (F (2, 44) = 2.73, p = .08) and no interaction effect of week by condition (F (4, 88) = 1.52, p = .20). Pairwise comparisons revealed that with regard to week data there was a significant difference in duration of crying between week one and week three (p = .04) and also between week two and week three (p = .03) across all conditions.

As can be seen in Figure 2 there is a steady decline in cry duration across the three weeks for SS participants and a steady but less marked decline for CS participants. The graph shows that the most marked decline in crying between week one and week two occurs for the Settle-sling group. However any effect of condition

might be masked by the small sample size and greater variability in scores for Sleep-sling participants.

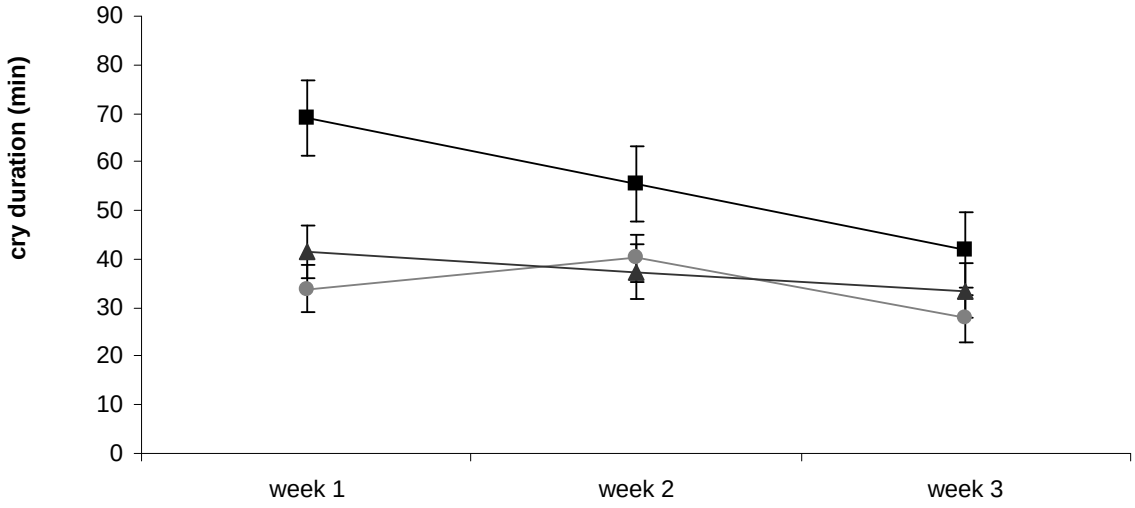

Figure 6.2. Cry duration for infants in the three conditions over the three week period

However as cry duration data was the mean daily cry duration irrespective of whether the specific intervention was in use or not, the final analysis investigates infant settle time ratings when the specific comforting techniques were in use. Participants rated the time that it took for their infant to settle using the following five point scale:

> 1 = Removed from sling (for SS and CS conditions). 1 = Longer than 1 hour to settle (for NS condition); 2 = settled within 1hour; 3 = settled within 45min; 4 = settled within 30 min; 5 = settled within 15min.

Table 6.4. Settle scale rating frequencies by condition

		Settle Scale Frequencies				Total Number of Ratings
	n	**2**	**3**	**4**	**5**	
NS	19	7	16	41	123	187
CS	8	2	4	3	25	34
SS	6	2	0	6	20	28

It can be seen in Table 4 that NS participants made substantially more recordings of infant settling times than either of the two sling groups; consequently mean rating per participant was calculated. Furthermore as the rating of '1' was defined differently for sling and non sling participants and therefore did not constitute comparable time points, all '1' ratings were excluded from the analyses. A minimum of three episodes of sling use/comforting data (of a rating of 2 or more) were then used to calculate a mean settle time rating for the chosen intervention for each participant.

Table 6.5. Mean settle time for infants in the three conditions (excluding ratings of 1).

Condition (n)	Mean Settle Rating and (SD)
NS (19)	4.4 (.62)
CS (8)	4.4 (.62)
SS (6)	4.5 (.92)

An ANOVA revealed no significant difference between the ratings for the three conditions. (F (2, 30) = .05, p = .95). Therefore contrary to the hypothesis the results did not indicate that infants in the Settle-sling settle more quickly than those using other comforting techniques. However these results need to be interpreted with caution due to the much smaller number of participants in the SS and CS conditions whose data was eligible to be included in the analysis. Additional Chi square analysis comparing the number of '1' ratings made by participants in the CS (n = 11) and SS (n = 18) conditions, revealed no significant difference (χ^2 (1) = 2.82, p = .12).

Indicating that, neither SS nor CS infants were removed from the slings, without settling, significantly more than the other.

4. Discussion.

This pilot study set out to investigate whether a specifically designed Settle-sling was more effective in settling crying infants than a commercially available sling or no-sling. The results of the settle time data do not support the hypothesis as no significant difference in settle-time was found; nor was there a significant effect of week by intervention on cry duration. The current results are similar to the findings of Barr *et al.* (1991) who found that supplementary carrying did not ease the crying of those infants who cried excessively. It is possible that the Settle-sling is most effective for infants with less extreme levels of crying at baseline. In addition, the small number of participants in the Settle-sling condition, make it difficult to reach definitive conclusions about the effectiveness of the Settle-sling.

Baseline analysis of temperament ratings using the EITQ indicated that there were no significant differences in mood or distractibility of infants across the three conditions. Whilst frequency of crying was also similar across conditions, those who were subsequently allocated to the Settle-sling group demonstrated a significantly greater duration of crying per day than those allocated to the No-sling group. This diary data stands in contrast to the EITQ data. As EITQ scores did not highlight differences in mothers' perceptions of their infants' affect it might be concluded that despite higher levels of actual crying mothers did not perceive their infants to have any greater negative affect than the mothers whose infants cried less. Due to the sensitive nature of this period in a family's life it was considered important to allow

participants to retain an element of choice in whether they accepted their allocated condition. It is possible therefore that those parents whose infants cried more were more likely to agree to try a new soothing technique and therefore more likely to opt for the Settle-sling condition, whereas those whose babies cried less were more likely to prefer to continue with their familiar routines and so chose the No-sling condition.

Because of the increased baseline in cry duration in the Sleep-sling group, a mixed model ANOVA examined cry duration over the three week period to examine a possible effect of condition by week in cry duration. However, whilst a significant effect of week was found, whereby week three crying was significantly less than both week one and week two, no effect of condition was found. There was no significantly greater reduction in cry duration in week two for Sleep-sling participants. This decrease in cry duration for all participants by week three might be attributable to the fact that the mean age of all infants, at baseline, was seven weeks and the reduction therefore might be maturational in nature, as crying normally reaches a peak around six weeks of age. Equally likely however is that, as participants became familiar with diary completion they might have become more discriminating between fussing and crying behaviour and therefore more selective as to what they recorded as crying, resulting in a general decrease in amount of crying recorded over time. So whilst diary completion is considered to be a relatively reliable method of infant data collection (Wurmser *et al.*, 2006) it does have some limitations.

Next we examined the amount of time it took for an infant to settle when a specific soothing technique was in use. However due to the differences in the labelling of point 1, scores of '1' were removed from the analyses. In the No-sling condition this did not result in any single participant being removed from the analysis but as some infants were, on occasion, reported as taking more than 1 hour to settle it

clearly skewed the mean settle time rating higher (i.e. settled more quickly) than it would have otherwise been for NS participants. For Control-sling and Settle-sling participants, however, due to the fewer number of recordings made by participants, some ratings of '1' resulted in participants being excluded from the analyses (fewer than three ratings of two or more), so in addition to skewing the data that was included, some participants were not included at all. Indeed 50% of Sleep-sling participants were removed from the analysis when ratings of 1 were eliminated. This reduced the sample to six and therefore only just acceptable for ANOVAs. Clearly the analyses would be improved with identical rating scales for all conditions and an increase in sample size for both sling conditions.

Table 4 reveals that No-sling participants made between four and five times as many recordings of settle data than the other two conditions. It would seem from the number of recordings made by this group that it was in some way easier for these parents to record settling episodes than it was for participants adopting a new method; or perhaps a mother, whose infant's crying episodes are shorter, is better able to record these events. It might also be that those in the No-sling group were more likely to be using a familiar method of comforting and therefore found it easier to record this. In fact it might be argued that a more familiar method of settling their infant would not only be the method that the parent considered to be most successful but also the one they would adopt most appropriately. Despite this potential advantage that No-sling participants had over participants in the Control-sling and Settle-sling conditions, who were trying new methods, the results do not show a significant advantage in terms of settling times for the No-sling participants.

In assessing the effectiveness of the Settle-sling, difficulties also arose with the Settle-sling itself. The slings given to participants in the study were prototype

versions and whilst they positioned the baby in the required way, the mechanics of the sling were complicated and somewhat difficult for parents to use without assistance. This resulted in several participants not using the sling the required number of times and so their data was lost from the analysis. In addition those participants who did use it often reported needing help to put the sling on and to position the baby. As a result, on a number of occasions, the sling was only used when another adult was available. Further, should the infant fall to sleep in the sling, there was no way to remove the infant without waking him/her. Alteration to the sling design, making it simpler for parents to use, particularly at a time when their infant is upset, would make it more comparable to other harness slings and improve future studies on the relative effectiveness of the slings.

Furthermore, future research should include a No-sling condition where participants are allocated to a specific comforting technique rather than given a free choice. Inevitably this will lead to a smaller sample size in this condition as some parents will not be willing to change established and effective routines. Nevertheless, the effectiveness of the different techniques would be more comparable, without confounding from parent or infant preference and familiarity.

Whilst the present study did not find the Settle-sling to be more effective at settling infants than other forms of comforting a number of improvements in the design of the study and the Settle-sling itself have been outlined which would improve the reliability of the findings. Previous research into methods of reducing excessive infant crying has been mixed, with no one generally agreed upon intervention. However the Settle-sling has been designed to combine a number of behavioural techniques that are thought to help alleviate infant crying and this unique approach therefore warrants further research. It is recommended that further studies

investigate the effectiveness of a Settle-sling that is simpler to use, which in turn will potentially increase the number of participants willing to enter this condition. This together with the allocation of control participants to specific non-sling techniques would improve the robustness of future studies.

As the problem of infant crying is a matter of concern for a large percentage of the population (Lobo, 2004) and the potential negative consequences of infant crying are significant (Barr *et al*., 2005 and Lee *et al*., 2007) together with the current lack of generally agreed upon interventions (Wikander, 1995) further research is recommended.

CHAPTER SEVEN

DISCUSSION AND CONCLUSIONS:

Infant cry and sleep patterns are a concern for most parents at some point in time, and the potential factors affecting infant routines are many and varied. Research has attempted to identify the main factors that are responsible for inter-individual variations in typical sleep, and cry patterns, and those factors that are responsible for problematic cry and sleep routines. However, as referred to in the introduction there has been no generally agreed protocol for research design, instruments and sample age, which vary from study to study. Consequently the findings have often been conflicting.

Four main limitations of the research to date were identified in the literature review. First, the cross-sectional approach adopted by most studies neglects to take into account intra-individual variation in infant routines across time (Alvarez & St James-Roberts, 1996; Goodlin-Jones *et al*., 2001; Sadeh *et al.,* 2009). The method adopted in this thesis followed the same sample of participants from 4 weeks to 13 months of age examining the relative effects of infant and maternal characteristics at different stages of development over the first year.

Second and related to the first issue, different studies recruit infants from different age ranges, with some studies including a relatively wide age range; this makes comparisons across studies difficult (Anders *et al*., 1992; Wolke *et al*., 2009). To avoid difficulties arising from selecting infants of widely differing ages, during this period of rapid development, the studies in this thesis focused on a narrower age range making findings relevant to a specific point in development. In addition between 6 months and 13 months developmental changes were explored using a

microgenetic approach following closely the changes across time within the same infants. This approach not only illuminated group trajectories in infant routines but also highlighted intra-individual differences across time

The third limitation of previous research identified in the literature review was the neglect of many studies to investigate the effect of, or control for, potentially confounding factors such as sex of the infant and birth-order, while others assume effects with little empirical evidence. That is, some studies assume no effect of sex or birth-order and do not examine potential differences, where others assume a potential effect of parity and select only first-born infants (Goodlin-Jones *et al*., 2001; Wake *et al*., 2006; Zuckerman, 1987). Throughout the thesis the potential effects of sex and birth-order of the infant on infant routines were explored.

The fourth and final limitation of previous research concerned intervention studies and their tendency to focus on investigating isolated behavioural interventions to ease infant crying (Hunziker & Barr, 1986; Peláez-Nogueras *et al*., 1996) when in reality mothers often rely on a number of strategies. This study was the first to examine the combined effectiveness of several interventions through the use of a Settle-sling which facilitates several behavioural techniques for soothing infant crying, such as optimal distance for eye contact, rocking and stroking.

It was acknowledged that although social, environmental and cultural factors have potential roles in infant routines these more distal factors were beyond the scope of the thesis which focused on the potential effects of the more immediate factors of infant and maternal characteristics. Further, although constitutional and health factors are also likely to affect infant routines (Sadeh and Anders 1993) the purpose of this study was to examine factors in healthy, typically developing infants. As discussed, a large body of research exists on infant cry and sleep routines, however different

studies have used widely differing age ranges. Where narrower age ranges have been studied these have often focused on clinical populations, such as infants with excessive crying. Few studies have examined sleep, feed and cry routines concurrently and fewer still in early infancy. The first study in this thesis investigated the extent to which these routines are related and infant characteristics that might be associated with each. Of the five factors examined in this study, birth-order, sex, feeding method, temperament and age, were all significantly related to infant routines and all three routines were, to some degree, related to one or more of the independent variables. Effects of birth order, sex, temperament and breast-feeding were found on sleep-wake pattern, an effect of infant age on crying and an effect of feeding type, temperament and birth-order on feeding.

The birth-order findings were in contrast to the findings of both Weissbluth (1995) who found no effect of birth-order in children from 6 months to 7 years on nap frequency or nap duration and that of Thunstrom (1999) who found no effect of birth-order on sleep for infants who were 6 to 18 months of age. However, as both of these studies focused on older children the current results might indicate that an effect of birth-order is limited to the first few months postpartum. What is not yet clear is whether these differences are due to intrinsic differences between first-born and subsequent born infants or extrinsic differences, such as the mother's experience, attitudes or competing commitments. One explanation proposed for the shorter sleep duration reported by primiparous mothers was that first time parents might intervene sooner when an infant displays signs of arousing. Mothers of subsequent infants may, through experience or because of competing child-care commitments, leave their infant to self-settle. Alternatively, de Weerth and Buitlaar (2007) suggested that first-born infants are more often assisted deliveries than subsequent-born infants and that

perhaps it is not birth-order per se that results in differences in routines but infants with more stressful deliveries. They propose that first-born infants are more likely to experience birth complications which might affect the parenting style of the mother, which is the proximal cause of increased waking and crying in first-born infants.

These two alternative explanations of parity effects were further explored in the online study. This study examined parity differences in maternal response latencies to infants waking from sleep while also controlling for the effects of infant and maternal characteristics, including, parity, sex, perinatal complications, attitudes, and perceptions of infant cry. We hypothesised that primiparous mothers might respond more quickly to a waking infant than multiparous mothers who might be more prepared to wait and see whether the infant will self-settle. The non significant trend suggested that while parity might have some affect on response latency, the effect was not in the direction hypothesised and indicated that multiparous mothers' response latencies tended to be shorter than that of primiparous mothers. The results of the online study did not explain the shorter sleep durations of first-born infants found in the first study.

It would seem that other factors, that might be related to parity, affect sleep duration such as maturation of the central nervous system (e.g. Sadeh & Anders, 1993), particularly in the first three months postpartum. Alternatively, the new role of being a 'mother' might increase the sensitivity of primiparous mothers to the sound of their own infant's cries, making response latencies to their *own* child in a naturalistic setting quicker than that of multiparous mothers. In contrast in the online study, which used cry stimuli from unfamiliar infants, response latency might be more susceptible to attitudes to child care generally and thus multiparous mothers, who tended to report more child-centred attitudes, recorded shorter response latencies to unfamiliar infants

than did primiparous mothers. Conflicting findings from the two studies might be due to such methodological differences. Whether primiparous mothers intervene more quickly than multiparous mothers in response to their own infants' cries needs to be explored further in a naturalistic setting, controlling for perinatal complications, with objective means of recording infant cry characteristics, to ensure comparibility of cry sounds, and of maternal response latencies. The potential role of parity in infant routines was further complicated by the results of the microgenetic study which found no effect of parity, on the developmental trajectory of cry or wake routines between six and 13 months of age. It was suggested, therefore that, as was found in the online study, parity effects might diminish beyond six months of age. Findings indicate that controlling for parity should be considered particularly in cross-sectional studies where infants across different age groups are compared.

In addition to the effects of parity, infant temperament was also found to predict infant sleep duration. The findings supported those of Touchette *et al.* (2005); Touchette *et al.* (2009) and Weissbluth (1984), whereby more positive infant affect ratings tended to be related to greater total sleep duration. However, it has been suggested that infant temperament interacts with maternal cognitions and maternal mental health in its effect on infant sleep routines. For example, Pauli-Pott *et al*. (2000) found that negative infant emotionality only affected mother-infant interactions when maternal depression was also present. Similarly Fish and Stifter (1993) suggest that parity moderates the relation between the mothers' personality and actual parenting attitudes and behaviours. Consequently, in order to explore further the earlier finding of an effect of temperament and parity on infant sleep, it was necessary to examine whether either of these were related to maternal mental health. The aim of the second study in this thesis (Chapter 3) was to determine

whether there was an interaction effect between parity and maternal mental health on infant sleep and whether there was an interaction effect between infant temperament and maternal mental health on infant sleep during this early stage of early infancy (i.e. 7-12 weeks).

Consistent with the findings of Dennis and Ross (2005) the findings indicated that even with young infants mothers with lower scores on measures of depression had infants who tended to sleep more than those of mothers with higher depression scores. Indeed, this trend was seen across all three measures of infant sleep, although only significant for total sleep duration. While infants with high TEITQ scores (more difficult temperament) also tended to have shorter sleep duration than those with lower TEITQ scores (easier temperament), the results were not significant and no interaction effect between infant temperament and maternal mental health was found. The results did indicate a non-significant interaction effect of parity and maternal mental health. That is MP mothers reported similar daily sleep durations for their infants irrespective of their own BDI score, whereas PP mothers with low BDI scores tended to record longer sleep durations than PP mothers with high BDI scores during early infancy. As the online study also indicated a potential effect of parity and a significant effect of mothers' perception of infant crying on response latency, further research exploring the nature of the relation between maternal mental health, parity, maternal perceptions and responding to infant cries is needed.

Clearly these cross-sectional data do not permit cause and effect conclusions to be drawn, but are indicative of multi-factorial and transactional relationships in infant sleep routines even as young as 12 weeks. Specifically they draw attention to the potential roles that maternal parity, infant temperament and maternal mental health have in infant sleep routines. It is suggested that the potential main and

moderating effects of infant temperament and maternal parity on infant routines are worth exploring further with a larger sample. Furthermore, while there is evidence of congruence between maternal ratings and independent ratings of actual infant behaviour (Bates, Freeland & Lounsbury, 1979; Rothbart, 1980) (As cited in Crockenberg and Acredolo) and Sadeh *et al*., (2009) found that parental reports of sleep best predicted actual sleep routine, it is possible that systematic error might be present in the data due to shared method variance as the mother was the only source of information on infant behaviour. Additional objective/independent measures to validate maternal responses are, therefore, recommended in future studies.

Some of the less controversial findings in the infant routines literature relate to the effect of feeding type on infant feed and wake frequency and the effect of infant age on crying. Consistent with most previous research (e.g. Brazelton, 1962; Lucas & St James Roberts, 1998; St James Roberts & Halil, 1991; Wolke *et al*., 1995; Wolke *et al.,* 1998) the findings of the first study found breast-feeding to be the main predictor of frequency of night waking and feed frequency, and age to be the main predictor of cry frequency for infants younger than 12 weeks. This relation was explored in the microgenetic study, the results of which indicated no relation between breast-feeding and infant wake and cry behaviour later in the infant's development. However a relation was found between early breast-feeding and later infant crying. Specifically, infants who were categorised as transitioning criers tended to be infants who were originally breast-fed. These findings should reassure mothers that while breast-feeding might be associated with more frequent waking in the early months, the pattern of increased waking does not generally continue into later infancy.

It was proposed, that whilst breast-fed infants might cry more frequently (pre-12 weeks) these crying episodes are predictable and functional and not considered by

the mothers to reflect a negative temperament. Indeed, as previous research indicates, temperamentally 'easy' infants are more likely to be breast-fed, whereas mothers of infants with more difficult temperaments are more likely to try alternative feeding methods in an attempt to settle the infant (Barr *et al.,* 1991).This might explain why transitioning criers, who also tended to be breast-fed, were found to have significantly more positive affect ratings than those with variable cry patterns. Perhaps in addition to cry frequency and duration, stability of cry routine is an important dimension to be considered in infant routine research. It might be interesting to examine, during early infancy, whether infants with less predictable patterns of crying are considered to be more temperamentally difficult than those with more stable routines.

The microgenetic study followed 34 of the original infants, every fifth week from six to thirteen months of age. This unique approach to studying the trajectory of infant cry and sleep-wake pattern over late infancy revealed both continuities and discontinuities in infant routines. Whilst age predicted cry frequency for infants during the first 12 weeks in the first study, the results of the microgenetic study indicated that between six months and 13 months cry duration reduces with age but not cry frequency. It is possible that a plateau is reached in cry frequency between 12 weeks and six months of age, similar to that found in cry duration (Brazelton, 1962). The results of the microgenetic study also revealed that of the two infant routines infant cry pattern appears to be a more stable characteristic of the infant than night waking across the time period studied. Moreover, some correlation between early infancy cry routine and later cry routine was found but no correlation between early wake patterns and later routines. It might be argued that cry routines seem more temperamentally determined and wakefulness more a consequence of maternal routines. Indeed when individual trajectories were investigated we found a substantial

degree of intra-individual variation in wakefulness across the study period that has not been revealed in cross-sectional studies or longitudinal studies examining group means.

From the findings discussed thus far, it seems that maternal and infant characteristics separately and jointly affect infant cry and sleep routines to varying degrees and that due to developmental changes, factors that might affect routines at one point are less influential at another point, and such variability might, in part, account for inconsistencies in previous findings. Perhaps the transactional model proposed by Sadeh and Anders (1993) might be more accurately regarded as a dynamic model whereby the relative importance of each interrelation in the model changes over time.

Indeed, the online study explored how parity might affect maternal responsiveness, a potential factor in this mother-child relation and contributor to infant routine development. Thus parity effects were explored in relation to maternal attitude to child-care and maternal perception of infant crying. Although no parity effect was found on perception, both infant age and maternal parity predicted attitude responses, with MP mothers, and those with older infants tending to report more child-centred attitudes than PP mothers and those with younger infants. The findings suggest that child-centred attitudes increase with greater maternal experience of child-care. However this needs to be explored further in relation to other aspects of maternal characteristics such as personality and cognitions about limit setting, as highlighted in the literature review.

Finally, the effectiveness of maternal choice of intervention was also investigated. Previous research has typically focused on single behavioural interventions such as chiropractic and massage interventions (Klougart, Nilsson &

Jacobsen, 1989), supplementary carrying (Hunziker & Barr, 1986) and increased eye contact (Lohaus Keller & Voelkers, 2001). However the results have been mixed, with no one generally agreed upon successful intervention. The final study investigated the effect of combining maternal interventions to ease infant crying, by using a newly developed settle-sling that was designed to facilitate several behavioural interventions at once.

Whilst no significant improvement in settle-time was found, the Settle-sling might be most effective for infants who had less extreme levels of crying at baseline as suggested by Barr *et al.* (1991), who argues that there is no reduction in excessive infant crying by carrying infants. However, effectiveness of the sling might be masked by the relatively small sample size and the fact that participants who were in the no-sling condition were allowed a free choice of comforting techniques. No definitive conclusions about the effectiveness of the Settle-sling were reached. As previous research into effective methods of reducing excessive infant crying has usually adopted a single intervention approach, this unique but instinctively natural approach, therefore, warrants further research.

Conclusions.

It seems from the collection of studies in this thesis that there are relations among infant routines within particular time frames. However, fewer associations were found between and even within routines across time. The findings are indicative of instability in infant routines, and inter-individual variation, indicative of a dynamic transactional model. For instance birth-order effects on infant wakefulness, feeding and maternal response latency are most evident for infants under six months of age. It

might be argued that during the neonatal period infants' exhibit routines that are largely governed by intrinsic factors but that over time a greater number of extrinsic factors come into play, thereby causing instability in routines over time.

Furthermore the norm referenced categorisation of infant routines, as employed in the microgenetic study, might go some way to standardising operational definitions of terms such as 'problem waking' and 'problem crying' or 'sleeping through the night' which are currently variously defined in the associated literature.

The areas of infant crying, feeding and sleeping routines are important areas of research, not only for infant and parental wellbeing but also in the allocation of government resources in postnatal and early years care. Furthermore empirical findings need to be more accessible to parents reassuring them of the variety and instability of infant routines and supporting parents in facilitating change in those aspects that can be changed and managing those aspects of infant routines that are more resistant to change.

Summary of the main findings:

- Birth-order/infant parity affects sleep duration especially in the first three months postpartum, and there is an indication that parity might interact with maternal mental health in its effect on infant sleep. Perhaps the experience of a prior child has positive effect on infant routines making the mother more competent or confident thereby moderating the negative effect of negative maternal mental health. Multiparous mothers held significantly more child centred attitudes to child rearing and, those of infants younger than 6 months, tended to report shorter response latencies to infant crying.

- There appears to be an effect of infant temperament on sleep duration in the first 3 months with more negative temperament ratings related to shorter concurrent sleep duration and more negative temperament ratings were predictive of less stable cry patterns in later infancy. Albeit some reservation exists due to shared method variance of maternal ratings

- Sex of the infant was found to be related to frequency of waking only; with males in the first three months waking more frequently than females. However no effect of sex was found in later infancy on either wake or cry trajectories.

- Breast-feeding was found to be related to an increase in the frequency of night waking and feed frequency during the early months. Early breast-feeding was also related to infant cry category in later months. More mothers might be encouraged to persevere with breast-feeding if they are made aware that although breast-feeding is related to more frequent waking in the first few months, there is no evidence to suggest that this establishes a poor sleeping routine for later infancy.

- Use of the settle-sling indicated that combining a number of behavioural interventions to soothe a crying infant might be more fruitful than reliance on one technique, although this might be only true for infants who do not have excessive crying

- Intra-individual variation in infant routines across the first year is common especially in infant signalled night waking. There is little relation between infant cry and sleep routines in early infancy and those of later infancy. It might be of benefit to mothers to learn that there is substantial discontinuity in infant routines. Mothers might be less concerned about a change in routine if they expect temporary changes to occur.

Future developments.

A fuller understanding of individual differences in the development of crying, feeding and sleeping requires further research and a number of improvements to the studies in this thesis are suggested. First, improvements in design, method and operational definitions should improve the quality of the data collected, and second, other potential influencing factors that extend the bounds of the current thesis need further examination.

With regard to research design, prospective studies with frequent time sampling should be the research design of choice, with perhaps even shorter time sampling intervals than reported here. This ought to provide a more detailed understanding of both the stability/instability and intra-individual variability in infant routines. With regard to methodological improvements, the use of additional objective means of data collection would be preferable to relying on maternal information alone, and reduce the likelihood of shared method variance as discussed in Chapter Two. For instance in addition to the use of the EITQ which is a reliable measure in itself more objective measures such as independent observation could be used to validate maternal ratings. Further, a number of operational definitions need refining.

With regard to ‘problem’ crying and waking a clearly defined and objective measure, was calculated in the microgenetic study. If this method of definition were more widely adopted this would facilitate the comparability of data and thus the understanding of the trajectory and factors affecting problem infant routines. Similarly, a more widely accepted understanding of what constitutes infant ‘fussing’ and what constitutes infant ‘crying’, needs to be established to facilitate accuracy of parental reports.

In addition to the methodological improvements the current thesis also highlighted additional factors that need further examination before a robust and coherent picture of changes in crying, feeding and sleeping in early development can be acquired. Other factors identified include wider contextual influences such as cultural and environmental influences; the effect of maternal personality more generally than simply maternal mental health; maternal cognitions regarding limit setting and competence; infant health and finally, where research examines infant routines at 6 months of age and beyond the potential effects of infant attachment on both crying and self-settling at night ought to be explored.

As highlighted in the microgenetic study (Chapter Four), future research might also consider examining alternative behavioral dimensions such as cry predictability. Predictability might affect a mother’s perception of infant crying and /or infant temperament just as much as frequency and duration of crying. Finally, previous work has often focused on either maternal cognitions and behaviour, or on infant behaviour. It is vital not only to look at the transactions between parents and infants and assess how behavior by one partner alters the dyad in terms of other but also how this relation changes over the first year.

With regard to intervention studies, the sling study highlighted that whilst evaluating multiple concurrent methods of soothing better reflects the natural soothing behaviour of mothers than evaluating single techniques in isolation does, it also became evident that mothers rely on a number of different techniques employed sequentially. Therefore future research into the effectiveness of any soothing technique needs to be explored in the context of the maternal behaviours that precede it.

A natural development to the research presented here would be to unify the different aspects of theses studies in a large scale, microgenetic study, with recruitment of participants taking place antenatally in order to control for the effects of maternal characteristics prior to birth. The study could examine the role of maternal responses in mediating the effect of maternal cognitions and /or personality on infant routines and follow how these variables interact with infant characteristics overtime. Such a study would provide researchers with a clearer understanding of the trajectory of infant routines and maternal and infant influencing factors and ultimately provide practitioners with objective, empirically based information on which to base advice given to parents.

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APPENDIX 1

1.1. Diary 1

Infant Behaviour Study

Daily Diary 1

Age of baby on first day of diary 1:

…..…….weeks, …..……days

Participant Number;…….

Diary Verbal Instructions

Using a blank page for reference:

- In this diary there is a separate page for each day. There are 8 pages, in case you need spares. Every page is the same and 'a day' runs from midnight of one day to midnight of the next.

- For each day, at the top of the page, we need; the time your baby wakes for that day and the time they go to sleep that night.

- There are 4 sections: feeding, sleeping, night waking and crying. As you will see from the left side of the page we are essentially looking for times and durations for all of these behaviours. The spaces to the right are for extra information where you might want to note any unusual events or changes in routine.

- So, if your baby wakes at 2am for a feed, then the time and duration would go under 'feed' **and** under night sleep pattern.

- Under the night sleep pattern section you might have an early hours waking such as 2am and then again a night waking for the following evening such as 11pm (as they are both within the same 24hr period).

- In an ideal world we would like all 7 days to be completed, but as life with a baby is so hectic we would appreciate it if you can keep it for 3-4 days. Whole

- Some people find it quite demanding at first but we have found that those people who manage best are those who keep the diary open, at the appropriate day, in some handy place and fill it in as the day goes on. We have found that people have most difficulty if they try to recall the whole day in order to complete it in the evening.

- Please feel free to use the first day as a 'trial run' (please note this if you do).

- Those who have completed the diary have found it quite interesting to look back over and have usually been able to identify some previously unnoticed pattern in their baby's routine, some have even asked for a copy as a keep-sake.

- At the front of the diary there is an example of a completed day and some guidance notes on completing the diary, however if you are having difficulty or uncertain about something our contact details are also there. Please contact us and we will try to help as best we can.

Diary
Instructions

Please complete the daily record of your baby's feeding, sleeping and crying routines, from **midnight** of one day to **midnight** of the next, as accurately as possible. You are welcome to choose whether you complete it as you go along, or in one go at the end of each day. It will help us to collect more accurate data, however, if you complete only those parts which you can recall. Please do not feel obliged to fill spaces where you have forgotten; a '?' would be sufficient thank you. Feel free to use the back of the sheet or a separate continuation sheet if necessary but please remember to identify the episode (time/date).

The 'observations' sections are opportunities for you to describe anything unusual that might help us, and you, to uncover a pattern in your baby's routine. **However, should you have any concerns about your baby's routine; participation in this study must not prevent you from contacting your GP/health visitor as normal.**

Please refer to guidance notes and diary example in the Appendix to assist you in the completion of the diary.

Thank you once again for participating in this study.

If you have any queries regarding the diary or wish to withdraw from the study please contact:

Fiona Kaley: Tel: 0191 3340442 email: f.m.kaley@durham.ac.uk

Or

Anna Groendahl: Tel: 0191 3343204

Guidance Notes for 'Observations' Sections

The following are suggestions on the type of information that you might wish to record in the 'observation' sections of the diary. The list is not exhaustive and is only a guide to the kinds of occurrences that might strike you as significant. Therefore they will not be necessary to enter every time.

Feeding:

Taking more of less time to breast feed / more or less formula milk.

Fussing, crying, discomfort during feed.

Reflux

More/less time to wind.

Day –time naps:

Longer/shorter than usual.

Fewer/more than usual.

Particularly easy / difficult to settle/wake.

Night-time sleep pattern:

Particularly easy/difficult to initially settle.

Particularly easy/difficult to settle after a disturbance.

When awake baby crying or wanting to play?

Crying:

Signs of physical discomfort such as:

Swollen tummy, legs drawn-up, back arched, flushed face, fists clenched, flatulence, intense cry inconsolable etc.

Time awake for today:			Time of sleep onset tonight:		
Feeds					
Event	Time of feed	Duration	Observations about baby's behaviour or changes to routine:		
1					
2					
3					
4					
5					
6					
7					
Day-time Naps					
Event	Time of Nap	Duration	How settled for nap	Observations about baby's behaviour or changes to routine:	
1					
2					
3					
4					
5					
Night-time sleep pattern					
Event	Time of wakening	Duration	How settled	Observations about baby's behaviour or changes to routine:	
1					
2					
3					
4					
Crying					
Event	Time of onset	Duration	How consoled	Sudden onset? Y or N	Signs of physical discomfort
1					
2					
3					
4					
5					
6					
7					
8					
Any other comments such as: fever, constipation, vaccinations or changes to routine etc.					

1.2. Early Infancy Temperament Questionnaire: Temperament Dimensions.

•**Activity**: The level and extent of motor activity;

•**Rhythmicity**: The degree of regularity, of functions such as eating, elimination and the cycle of sleeping and wakefulness;

•**Approach**: The response to a new object or person, in terms of whether the child accepts the new experience or withdraws from it;

•**Adaptability**: The adaptability of behaviour to changes in the environment;

•**Threshold**: The threshold, or sensitivity, to stimuli;

•**Intensity**: The intensity, or energy level, of responses;

•**Mood**: The child's general mood or "disposition", whether cheerful or given to crying, pleasant or fussy, friendly or unfriendly;

•**Distractibility**: The degree of the child's distractibility from what he is doing;

•**Persistence**: The span of the child's attention and his persistence in an activity.

1.3. Early Infancy Questionnaire

The Carey Temperament Scales

Early Infancy Temperament Questionnaire

for 1-to-4-month-old infants

by Barbara Medoff-Cooper, PhD, William B. Carey, MD, and Sean C. McDevitt, PhD

Infant's Name _____ Gender _____

Infant's Date of Birth ____/____/____ Present Age _____
Month Day Year

Rater's Name _____

Rater's Relationship to Infant _____

Date of Rating ____/____/____
Month Day Year

Instructions

1. There are no right or wrong or good or bad answers, only descriptions of your infant.
2. Please base your rating on your infant's recent and current behavior (the last four to six weeks).
3. Rate each question separately. Some items may seem alike but are not the same. Do not purposely try to present a consistent picture of your infant.
4. Use extreme ratings where appropriate. Try to avoid rating only near the middle of each scale.
5. Rate each item quickly. If you cannot decide, skip the item and come back to it later.
6. Rate every item. Please skip any item that you are unable to answer due to lack of information or any item that does not apply to your infant.
7. Consider only your own impressions and observations of the infant.

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Using the scale below, please darken the circle in the space that tells how often the infant's recent and current behavior has been like the behavior described by each item.

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS

		ALMOST NEVER					ALMOST ALWAYS
1. The infant lies still (little squirming) when held in mother's arms between feedings.	1	①	②	③	④	⑤	⑥
2. The infant's fussy period occurs at about the same time of day (morning, afternoon, night).	2	①	②	③	④	⑤	⑥
3. For the first few minutes in a new place or situation (new store or home) the infant is fretful.	3	①	②	③	④	⑤	⑥
4. The infant accepts face washing at any time without protest.	4	①	②	③	④	⑤	⑥
5. The infant's hungry cry is a scream rather than a whimper.	5	①	②	③	④	⑤	⑥
6. The infant cries when awake and left alone.	6	①	②	③	④	⑤	⑥
7. The infant repeats vocalization (coos, babbles) for several minutes.	7	①	②	③	④	⑤	⑥
8. The infant continues to fuss during diaper change in spite of efforts to distract him/her with patting or singing.	8	①	②	③	④	⑤	⑥
9. The infant indicates discomfort (fusses or squirms) when diaper is soiled with bowel movement.	9	①	②	③	④	⑤	⑥
10. The infant lies still (little squirming) during hair brushing.	10	①	②	③	④	⑤	⑥
11. The infant gets sleepy about the same time each evening (within 1/2 hour).	11	①	②	③	④	⑤	⑥
12. The infant appears bothered (cries, squirms) when first put down to sleep in a different place than usual.	12	①	②	③	④	⑤	⑥
13. The infant resists (squirms, pulls away) hair brushing.	13	①	②	③	④	⑤	⑥
14. The infant vigorously cries when sleepy.	14	①	②	③	④	⑤	⑥
15. The infant smiles, or coos during nail cutting.	15	①	②	③	④	⑤	⑥
16. The infant will continuously look at mobile or toy in crib for 5 minutes or more.	16	①	②	③	④	⑤	⑥
17. The infant continues to resist when getting dressed and undressed despite efforts to distract him/her (singing, talking).	17	①	②	③	④	⑤	⑥
18. The infant reacts even to gentle touch (startles, laughs, wiggles).	18	①	②	③	④	⑤	⑥
19. The infant moves about much (kicks, waves arms, squirms) during dressing and undressing.	19	①	②	③	④	⑤	⑥
20. The infant wants and takes milk feedings at about the same times (within 1 hour) from day to day.	20	①	②	③	④	⑤	⑥
21. The infant objects (cries, frets) if someone other than main caregiver gives care.	21	①	②	③	④	⑤	⑥
22. The infant adjusts to change in sleep time within 2 to 3 days.	22	①	②	③	④	⑤	⑥
23. The infant displays much feeling (vigorous smile or cry), during dressing and undressing.	23	①	②	③	④	⑤	⑥
24. The infant is fussy during a bath (cries, frowns).	24	①	②	③	④	⑤	⑥
25. The infant will continuously watch parents during diaper changing.	25	①	②	③	④	⑤	⑥
26. If fussing in bath, infant will continue to protest despite efforts to quiet him (talking, singing to him/her).	26	①	②	③	④	⑤	⑥
27. The infant reacts (startles, stares) to sudden change in lighting (turning on light).	27	①	②	③	④	⑤	⑥
28. The infant lies still (little kicking, splashing) in bath.	28	①	②	③	④	⑤	⑥
29. The infant's time of waking in the morning varies greatly (by 1 hour or more) from day to day.	29	①	②	③	④	⑤	⑥
30. The infant turns head away and looks for mother when held by new person.	30	①	②	③	④	⑤	⑥
31. The infant adjusts to change in place of sleeping within 2 or 3 days.	31	①	②	③	④	⑤	⑥
32. The infant displays much feeling (vigorous smile or cry) during diapering.	32	①	②	③	④	⑤	⑥
33. The infant is fussy when put down for sleep (cries, frets).	33	①	②	③	④	⑤	⑥
34. The infant continuously watches parents during changing of clothes.	34	①	②	③	④	⑤	⑥
35. The infant's hunger cry can be stopped for over a minute by picking up or giving pacifier.	35	①	②	③	④	⑤	⑥

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS

		ALMOST NEVER					ALMOST ALWAYS
36. The infant reacts (startles, cries) to sudden loud noises.	36	①	②	③	④	⑤	⑥
37. The infant moves much (squirms, bounces, kicks) when lying awake in crib.	37	①	②	③	④	⑤	⑥
38. The infant takes daytime naps at different times (over 1 hour difference) from day to day.	38	①	②	③	④	⑤	⑥
39. The infant does not feed well (fusses) when in new situation.	39	①	②	③	④	⑤	⑥
40. The infant resists (squirms, fusses) regular nail cutting.	40	①	②	③	④	⑤	⑥
41. The infant is noisy (vocalizing loudly) on waking up.	41	①	②	③	④	⑤	⑥
42. The infant is fussy when burped (cries, fusses) during feeding.	42	①	②	③	④	⑤	⑥
43. The infant persistently (over 5 minutes) watches parent's face while parent is talking or singing.	43	①	②	③	④	⑤	⑥
44. The infant can be distracted (singing, patting) from fussing or squirming during hair brushing.	44	①	②	③	④	⑤	⑥
45. The infant notices (quiets, turns head) to music or voices in the next room.	45	①	②	③	④	⑤	⑥
46. The infant moves about much (kicks, waves arms, squirms) during diapering.	46	①	②	③	④	⑤	⑥
47. The infant wants an extra feeding at a different time each day (over 1 hour difference).	47	①	②	③	④	⑤	⑥
48. The infant accepts right away a change in time of feeding.	48	①	②	③	④	⑤	⑥
49. The infant resists changes in feeding schedule (1 hour or more) even after two tries.	49	①	②	③	④	⑤	⑥
50. The infant cries loudly when diaper is soiled with bowel movement.	50	①	②	③	④	⑤	⑥
51. The infant lies quietly, making happy noises upon waking up.	51	①	②	③	④	⑤	⑥
52. The infant continuously turns head toward the sound of a person talking (for 5 minutes or more).	52	①	②	③	④	⑤	⑥
53. The infant can be soothed (patted, rocked) when sleepy.	53	①	②	③	④	⑤	⑥
54. The infant notices (reacts differently) to a change in person giving care.	54	①	②	③	④	⑤	⑥
55. The infant moves much during feeding (squirms, kicks, waves arms).	55	①	②	③	④	⑤	⑥
56. The infant sucks for the same amount of time during a feeding (within 10 minutes).	56	①	②	③	④	⑤	⑥
57. The infant accepts his/her bath any time of day without resisting.	57	①	②	③	④	⑤	⑥
58. The infant cries during a bowel movement.	58	①	②	③	④	⑤	⑥
59. The infant watches parent's face for less than a minute during parent/child play activity.	59	①	②	③	④	⑤	⑥
60. The infant continues to cry when frightened despite several minutes of soothing (picked up, patted).	60	①	②	③	④	⑤	⑥
61. The infant turns away from parents to look at noise or movements in the room.	61	①	②	③	④	⑤	⑥
62. The infant lies still during nail cutting.	62	①	②	③	④	⑤	⑥
63. The infant's period of greatest physical activity comes at different times of the day (morning, afternoon, evening).	63	①	②	③	④	⑤	⑥
64. The infant objects (fusses, squirms) to being bathed by a different person even after 2 or 3 tries.	64	①	②	③	④	⑤	⑥
65. The infant is pleasant (coos, smiles) during face washing.	65	①	②	③	④	⑤	⑥
66. The infant amuses self for 15 minutes or more in crib (looking at doll or toy).	66	①	②	③	④	⑤	⑥
67. The infant notices (startles) sudden movements or bumps when in stroller or carriage.	67	①	②	③	④	⑤	⑥
68. The infant's day time naps are varied in length from day to day (more than 1-hour difference).	68	①	②	③	④	⑤	⑥
69. The infant resists (squirms, fusses) during routine dressing or undressing.	69	①	②	③	④	⑤	⑥
70. The infant smiles or coos during hair washing.	70	①	②	③	④	⑤	⑥
71. The infant acts the same when the diaper is wet or dry.	71	①	②	③	④	⑤	⑥
72. The infant's bowel movements are the same time each day (within 1 hour).	72	①	②	③	④	⑤	⑥

1 MOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS		ALMOST NEVER					ALMOST ALWAYS
The infant accepts routine washing of diaper area.	73	①	②	③	④	⑤	⑥
The infant is positive (smiles, coos) when he/she sees mother.	74	①	②	③	④	⑤	⑥
The infant reacts (startles) to differences in the temperature of the bath water.	75	①	②	③	④	⑤	⑥
The infant is fussy for several minutes after feedings.	76	①	②	③	④	⑤	⑥

GENERAL IMPRESSIONS OF INFANT'S TEMPERAMENT

:omparison with other infants you know who are the same age as your infant, how would you rate your nt in the following areas? Mark 1 to 6 on the right to correspond to the descriptions below.

Activity level-the amount of physical motion during daily routine. 1-very inactive 2-inactive 3-somewhat inactive 4-somewhat active 5-active 6-very active	1	①	②	③	④	⑤	⑥
Rhythmicity-regularity of bodily functioning in sleep, hunger, bowel movements, etc. 1-very regular 2-regular 3-somewhat regular 4-somewhat irregular 5-irregular 6-very irregular	2	①	②	③	④	⑤	⑥
Approach-responses to new persons,places,events. 1-not hesitant 2-very slightly hesitant 3-somewhat hesitant 4-moderately hesitant 5-hesitant 6-very hesitant	3	①	②	③	④	⑤	⑥
Adaptability-the ease/difficulty with which your infant can change to socially acceptable behavior. 1-very quick to adapt 2-adaptable 3-somewhat adaptable 4-somewhat slow to adapt 5-slow to adapt 6-very slow to adapt	4	①	②	③	④	⑤	⑥
Intensity-the amount of energy in a response, whether negative or positive. 1-very mild 2-mild 3-somewhat mild 4-somewhat intense 5-intense 6-very intense	5	①	②	③	④	⑤	⑥
Mood-general amount of pleasant or unpleasant feelings. 1-very pleasant 2-pleasant 3-somewhat pleasant 4-somewhat unpleasant 5-unpleasant 6-very unpleasant	6	①	②	③	④	⑤	⑥
Persistence/Attention Span-how long your infant stays with a task or activity. 1-very persistent 2-persistent 3-somewhat persistent 4-somewhat nonpersistent 5-nonpersistent 6-very nonpersistent	7	①	②	③	④	⑤	⑥
Distractibility-the effect of external stimuli (sounds, persons, etc.) on ongoing behavior. 1-very often distracted 2-often distracted 3-regularly distracted 4-sometimes distracted 5-seldom distracted 6-rarely distracted	8	①	②	③	④	⑤	⑥
Threshold-general sensitivity or insensitivity to stimuli (sound, odor, taste, light, etc.). 1-very nonreactive 2-nonreactive 3-somewhat nonreactive 4-somewhat sensitive 5-sensitive 6-very sensitive	9	①	②	③	④	⑤	⑥
How manageable is this infant? 1-very easy 2-easy 3-somewhat easy 4-somewhat difficult 5-difficult 6-very difficult	10	①	②	③	④	⑤	⑥

1.4. Consent Form

Infant Behaviour Study
Consent form

Have you read the Participant Information Sheet? Yes/No

Have you had the opportunity to ask questions and to discuss the study? Yes/No

Have you received satisfactory answers to all of your questions? Yes/No

Have you received enough information about the study and the intended uses of and access arrangements to any data which you supply? Yes/No

Were you given enough time to consider whether you want to participate? Yes/No

Who have you spoken to?.....

Are you involved in any other research project? Yes/No

Do you consent to participating in the study? Yes/No

Do you understand that you are free to withdraw from the study:

At any time and
Without having to give a reason for withdrawing and
Without any adverse effect of any kind? Yes/No

Signed……..Date…….

Name (in block capitals)……...…
Participant Number……..

Infant Behaviour Study
Personal Details

1.5. Personal Details

Participant number**……**

Your Name:……..……

Address:……...…….

……...…

Telephone and/or email details:……...……

…….….

Baby's name:……Sex of baby? M F

Baby's D.O.B:…….Birth Weight……

Baby is currently breast fed	Yes	No
Baby is currently bottle fed	Yes	No
Baby is currently formula fed	Yes	No
Baby was born between 37 and 42 weeks gestational age	Yes	No
Is this baby your first born?	Yes	No
Do you and/or your partner smoke?	Yes	No
Does your baby have any diagnosed condition?	Yes	No

If so please briefly explain…….……..
…….…….

Did you or your baby experience any complications during pregnancy?	Yes	No

If so please briefly explain…..…….……
……..……

Did you or your baby experience any complications during birth?	Yes	No

If so please briefly explain……..…….……
……..……

APPENDIX 2

2.1. Beck Depression Inventory

BDI-II

Date:

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation: _____ Education: _____

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that 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, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes 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 anymore 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.

_____ Subtotal Page 1

Continued on Back

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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 that 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 and 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. Changes 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. Changes 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.

19. 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 the 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.

22 23 24 25 26 27 28 29 30 A B C D E

_____ Subtotal Page 2
_____ Subtotal Page 1
_____ Total Score

APPENDIX 3

3.1. Infant Routines Questionnaire

Infant Routines Questionnaire

This questionnaire is examining consistency and variability in infants' routines over time. There are no right or wrong answers.

In answering the following questions please think about your baby's routine over the **last three days**. If your baby has been 'out of sorts' or unwell during the last three days please use your baby's **most recent normal routine** to guide your answers. Thank you.

Baby's age is: .....weeks.

A. Feeds

On average:

A1. How many feeds (milk or solids) does your baby have per day?
.....

A2. Do you still breast-feed?

Always Most times Sometimes Occasionally Never

B. Night waking

On average:

B1. How often does your baby wake through the night? ……

B2. How long is your baby awake each time? …….

B5. How is your baby usually settled back to sleep?

…….....
.....

…….....
.....

D. Crying

On average:

D1. How many crying episodes does your baby have per day?
……

D2. How long do these episodes last? …….

D3. What are the best ways of comforting your baby?

……
……

……
……

Thank you

APPENDIX 4

4.1. Audio Clips

Part 1

See CD for

Long cry 1
Long cry 2

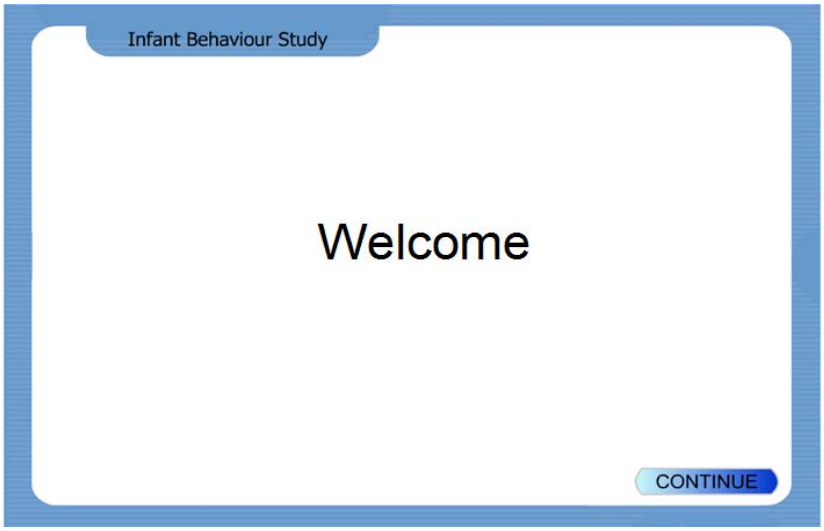
Part 2

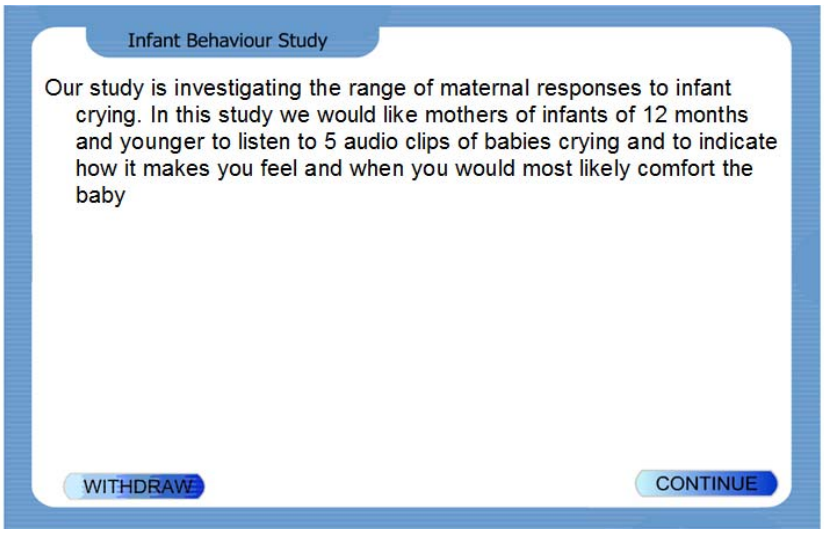
Short cry 1
http://www.youtube.com/watch?v=qS7nqwGt4-

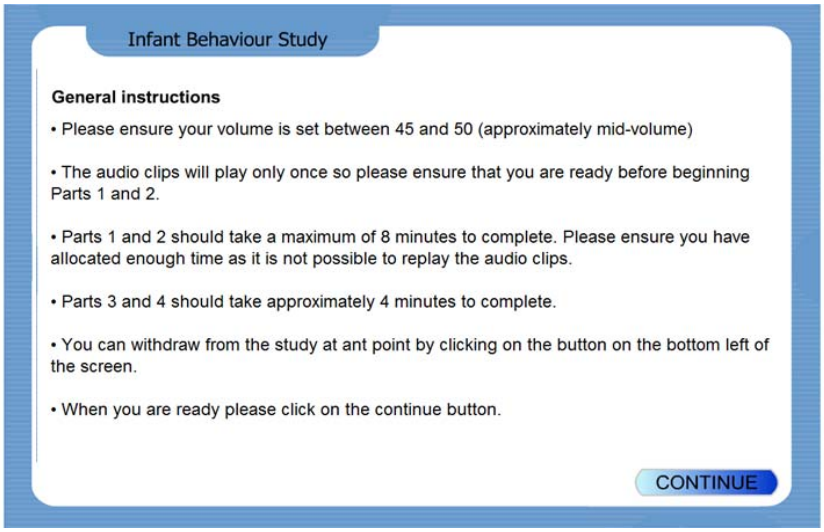
Short cry 2
http://www.youtube.com/watch?v=gNBEzvaSjz8&feature=related

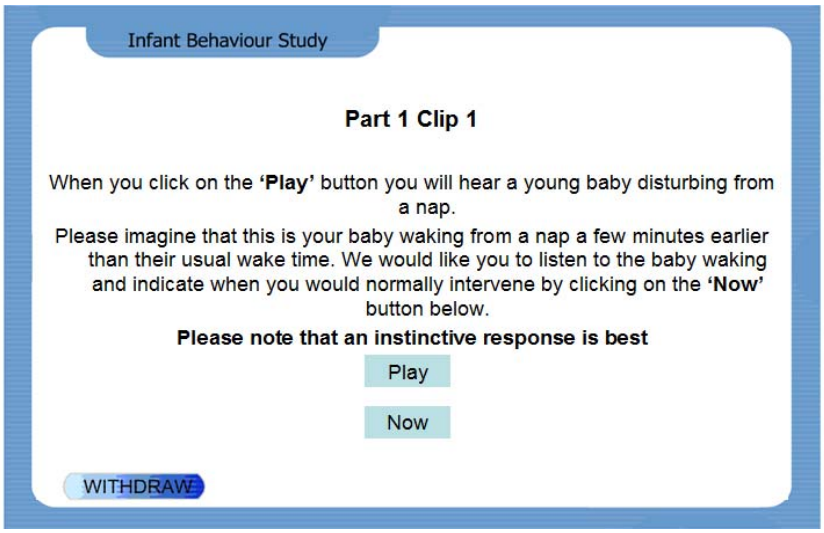
Short cry 3
http://www.youtube.com/watch?v=cgFXyJ3hZwQ&feature=related

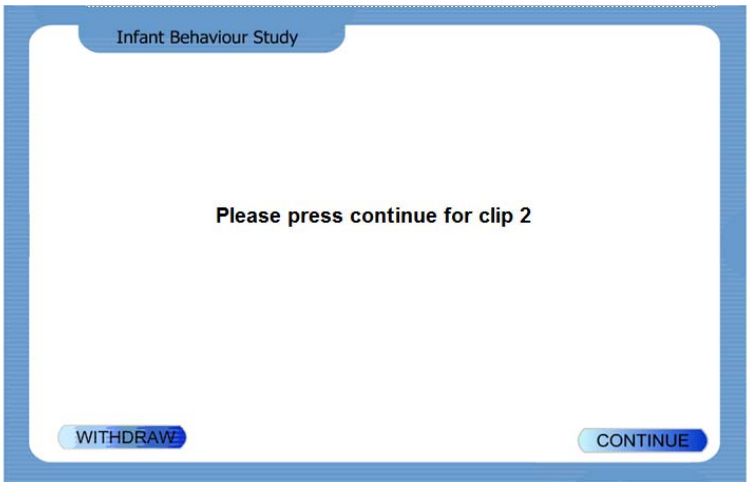
4.2. Online Survey

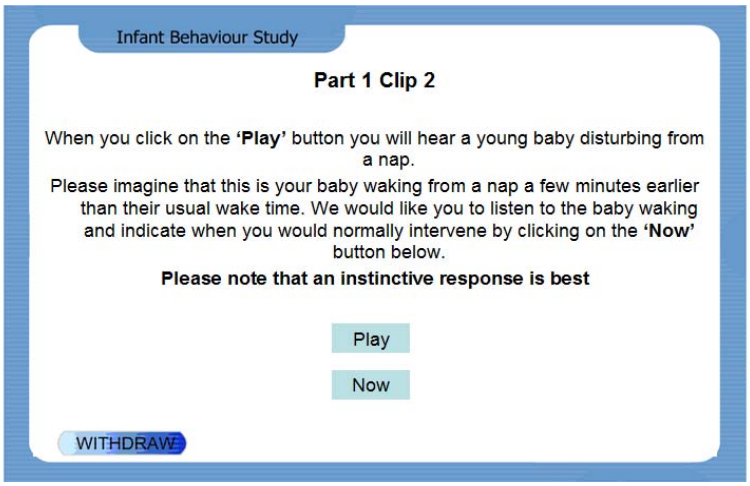


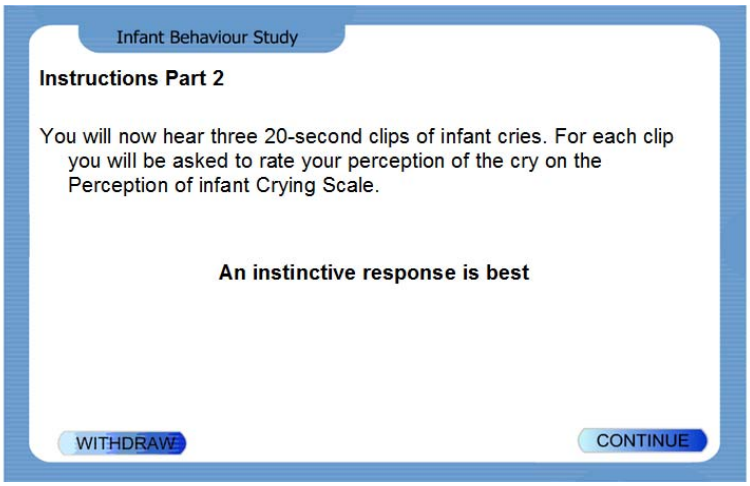


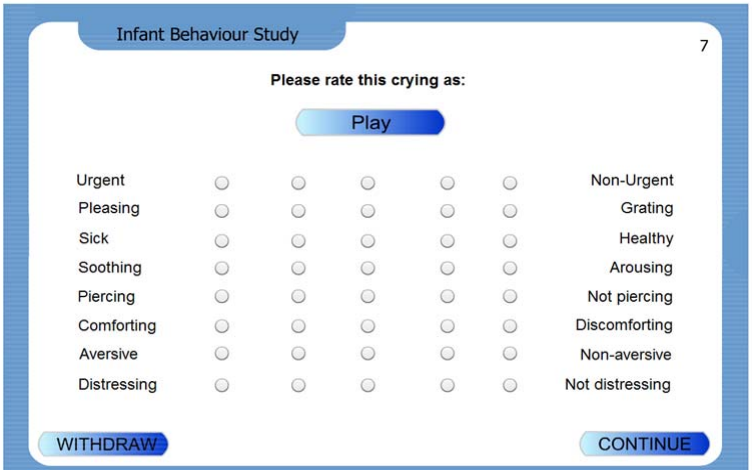

Infant Behaviour Study
General instructions
• Please ensure your volume is set between 45 and 50 (approximately mid-volume)
• The audio clips will play only once so please ensure that you are ready before beginning Parts 1 and 2.
• Parts 1 and 2 should take a maximum of 8 minutes to complete. Please ensure you have allocated enough time as it is not possible to replay the audio clips.
• Parts 3 and 4 should take approximately 4 minutes to complete.
• You can withdraw from the study at ant point by clicking on the button on the bottom left of the screen.
• When you are ready please click on the continue button.
CONTINUE

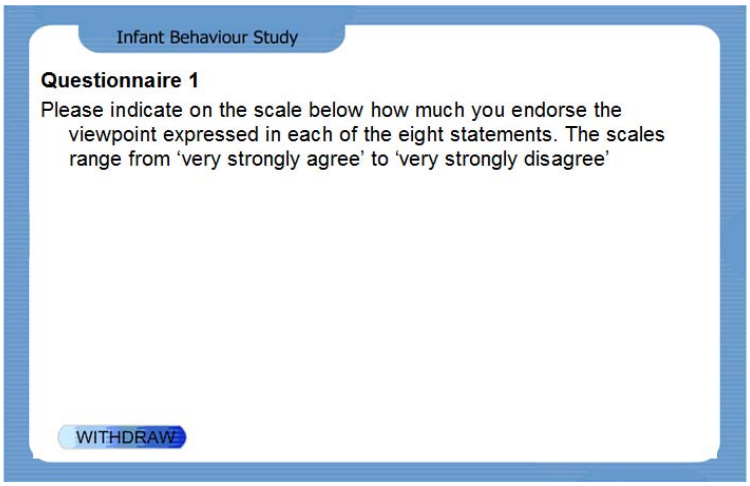

Infant Behaviour Study
Part 1 Clip 1
When you click on the 'Play' button you will hear a young baby disturbing from a nap.
Please imagine that this is your baby waking from a nap a few minutes earlier than their usual wake time. We would like you to listen to the baby waking and indicate when you would normally intervene by clicking on the 'Now' button below.
Please note that an instinctive response is best
Play
Now
WITHDRAW

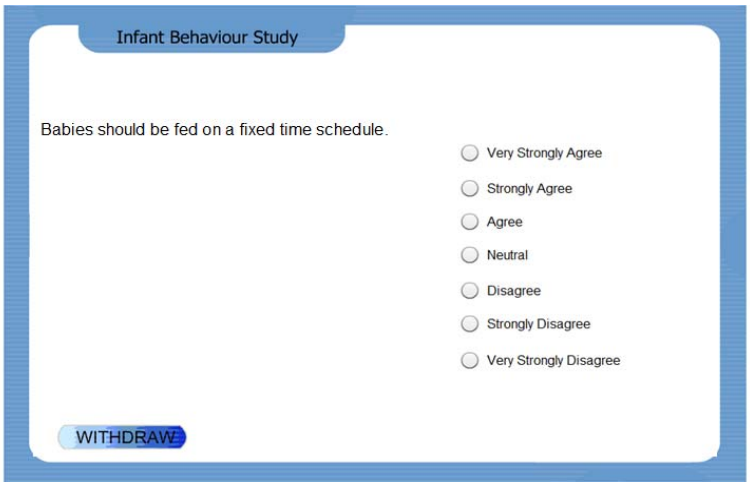

Infant Behaviour Study
Please press continue for clip 2
WITHDRAW
CONTINUE

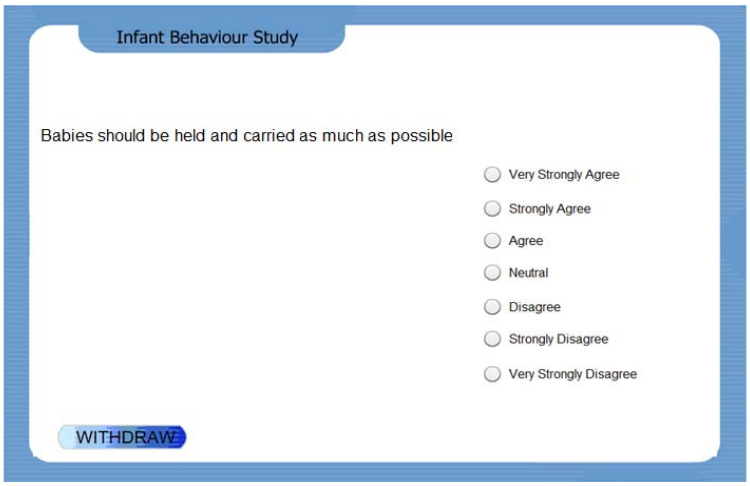

Infant Behaviour Study
Part 1 Clip 2
When you click on the 'Play' button you will hear a young baby disturbing from a nap.
Please imagine that this is your baby waking from a nap a few minutes earlier than their usual wake time. We would like you to listen to the baby waking and indicate when you would normally intervene by clicking on the 'Now' button below.
Please note that an instinctive response is best
Play
Now
WITHDRAW

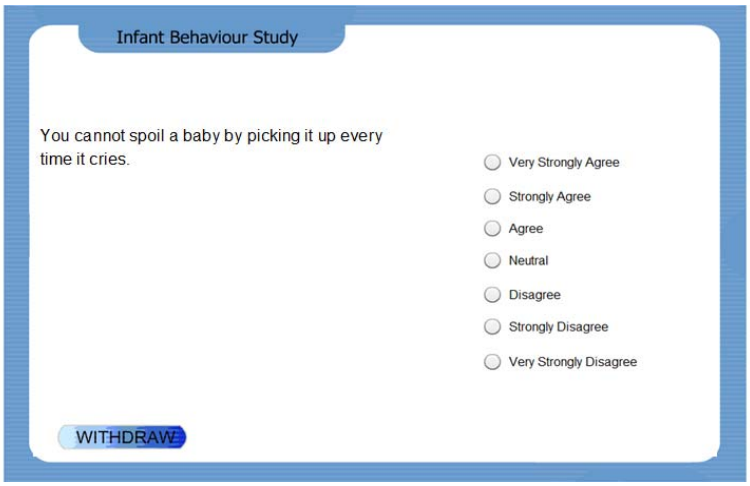

Infant Behaviour Study
Instructions Part 2
You will now hear three 20-second clips of infant cries. For each clip you will be asked to rate your perception of the cry on the Perception of infant Crying Scale.
An instinctive response is best
WITHDRAW
CONTINUE

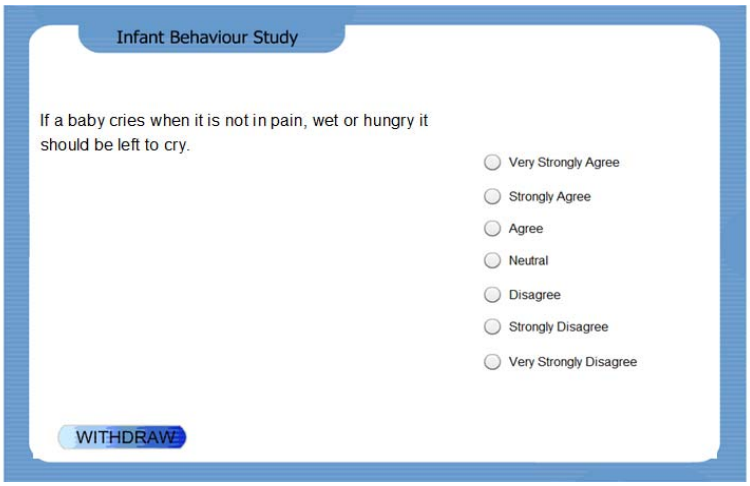

Infant Behaviour Study
7
Please rate this crying as:
Play
Urgent
Non-Urgent
Pleasing
Grating
Sick
Healthy
Soothing
Arousing
Piercing
Not piercing
Comforting
Discomforting
Aversive
Non-aversive
Distressing
Not distressing
WITHDRAW
CONTINUE

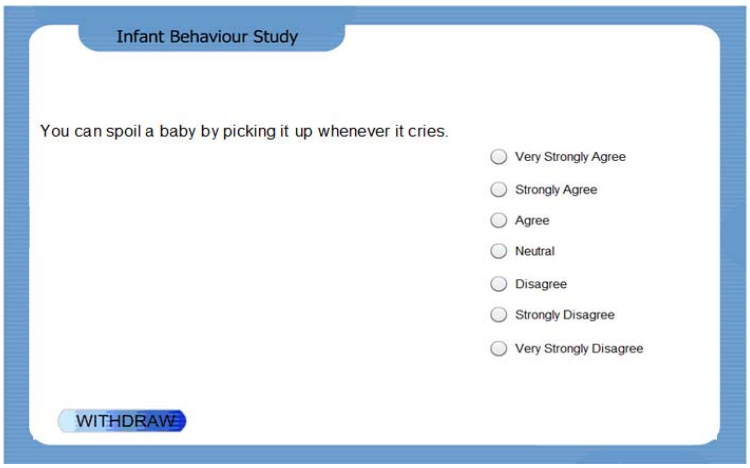

Infant Behaviour Study
Questionnaire 1
Please indicate on the scale below how much you endorse the viewpoint expressed in each of the eight statements. The scales range from 'very strongly agree' to 'very strongly disagree'
WITHDRAW

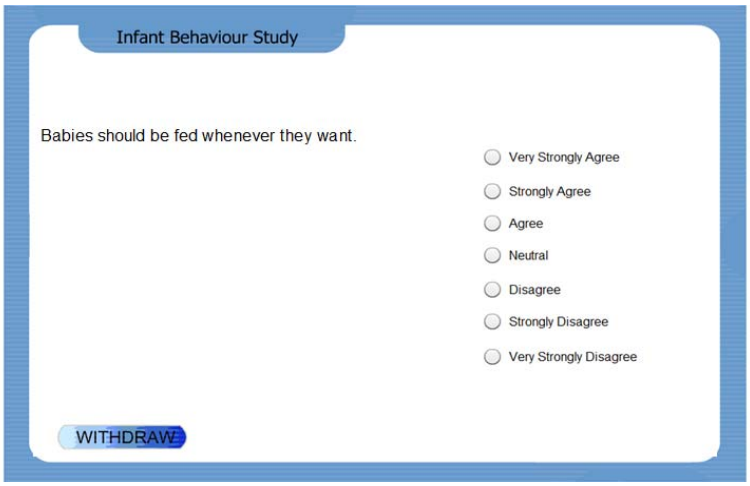

Infant Behaviour Study
Babies should be fed on a fixed time schedule.
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

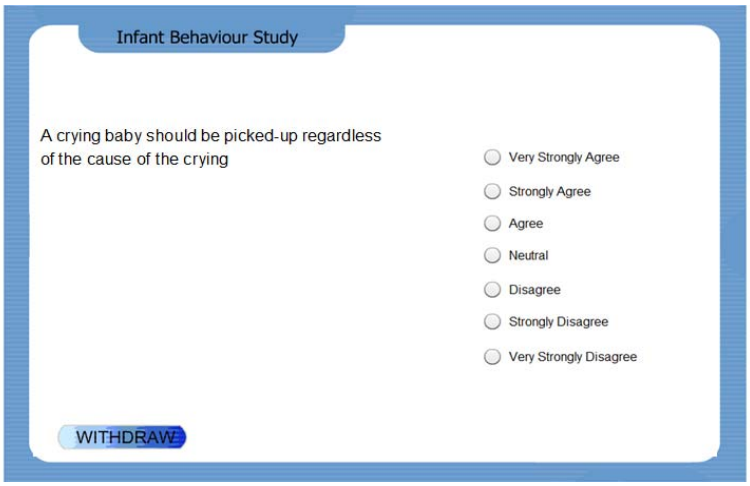

Infant Behaviour Study
Babies should be held and carried as much as possible
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

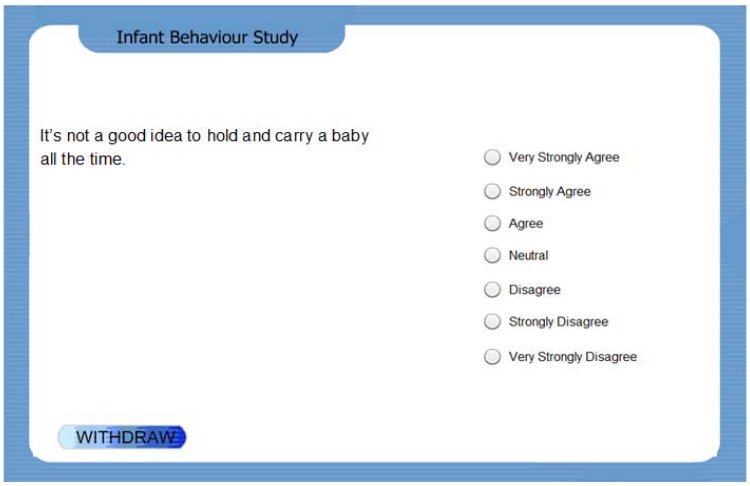

Infant Behaviour Study
You cannot spoil a baby by picking it up every time it cries.
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

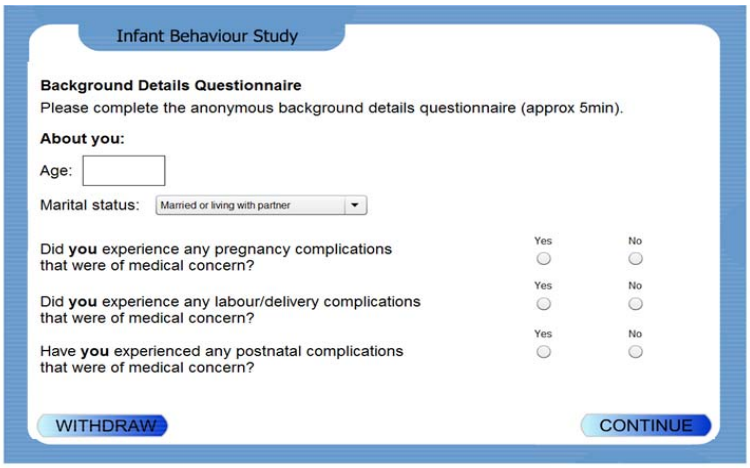

Infant Behaviour Study
If a baby cries when it is not in pain, wet or hungry it should be left to cry.
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

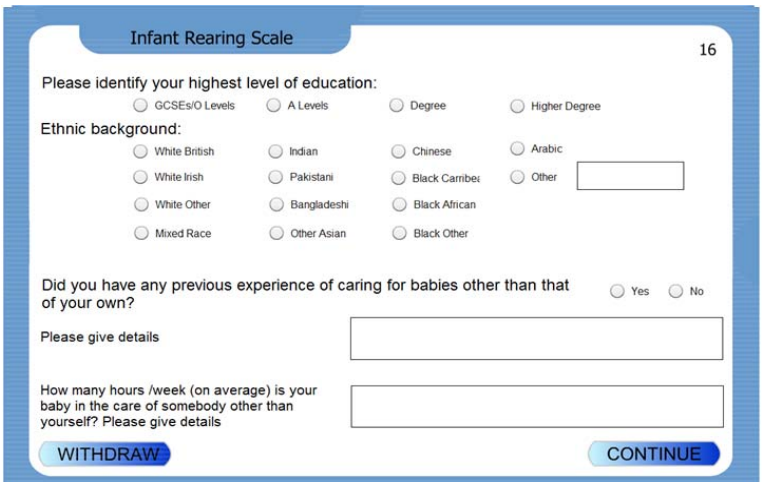

Infant Behaviour Study
You can spoil a baby by picking it up whenever it cries.
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

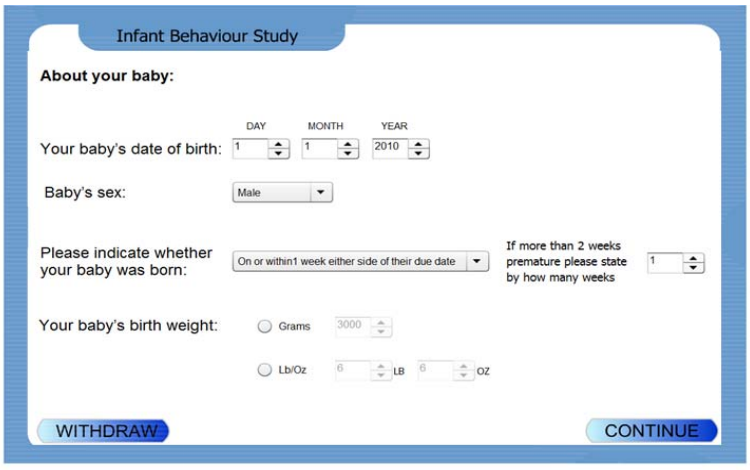

Infant Behaviour Study
Babies should be fed whenever they want.
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

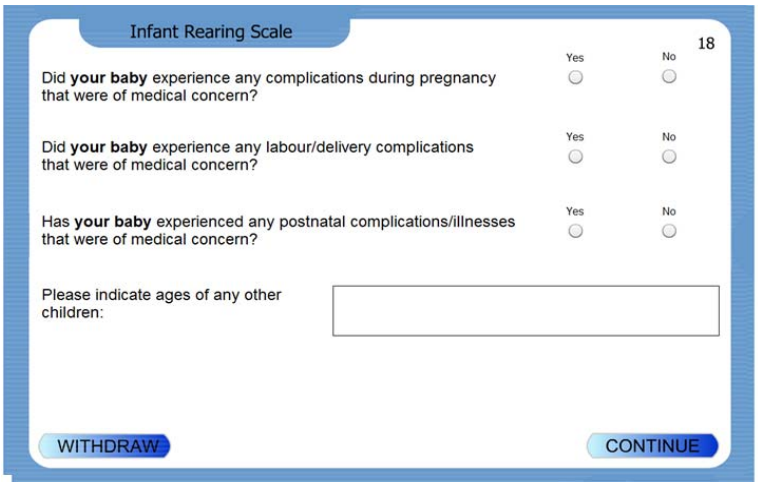

Infant Behaviour Study
A crying baby should be picked-up regardless of the cause of the crying
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

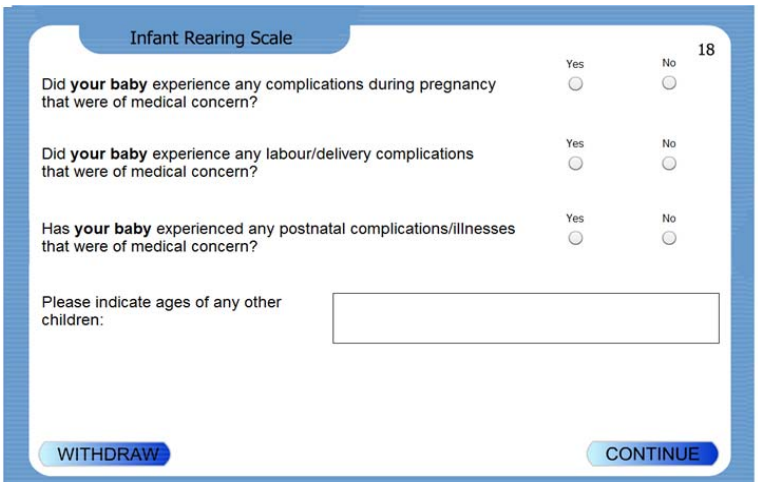

Infant Behaviour Study
It's not a good idea to hold and carry a baby all the time.
Very Strongly Agree
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
Very Strongly Disagree
WITHDRAW

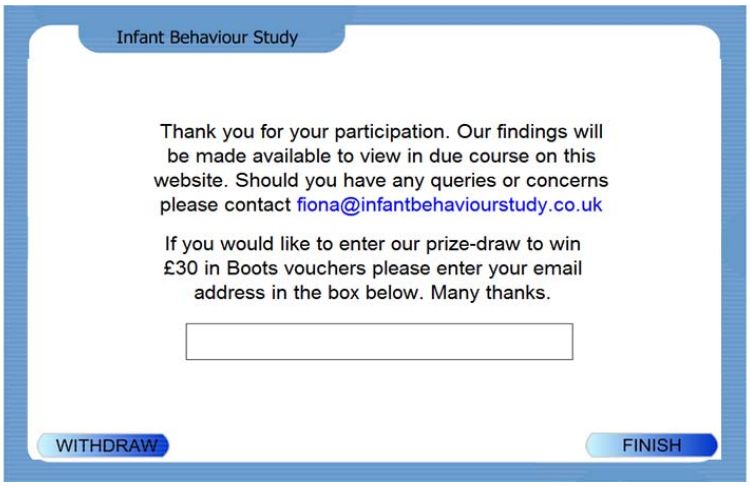

Infant Behaviour Study
Background Details Questionnaire
Please complete the anonymous background details questionnaire (approx 5min).
About you:
Age:
Marital status:
Married or living with partner
Did you experience any pregnancy complications that were of medical concern?
Yes
No
Did you experience any labour/delivery complications that were of medical concern?
Yes
No
Have you experienced any postnatal complications that were of medical concern?
Yes
No
WITHDRAW
CONTINUE


Infant Rearing Scale
16
Please identify your highest level of education:
GCSEs/O Levels
A Levels
Degree
Higher Degree
Ethnic background:
White British
Indian
Chinese
Arabic
White Irish
Pakistani
Black Caribbe
Other
White Other
Bangladeshi
Black African
Mixed Race
Other Asian
Black Other
Did you have any previous experience of caring for babies other than that of your own?
Yes
No
Please give details
How many hours /week (on average) is your baby in the care of somebody other than yourself? Please give details
WITHDRAW
CONTINUE


Infant Behaviour Study
About your baby:
DAY
MONTH
YEAR
Your baby's date of birth:
1
1
2010
Baby's sex:
Male
Please indicate whether your baby was born:
On or within1 week either side of their due date
If more than 2 weeks premature please state by how many weeks
1
Your baby's birth weight:
Grams
3000
Lb/Oz
6
LB
6
OZ
WITHDRAW
CONTINUE


Infant Rearing Scale
18
Yes
No
Did your baby experience any complications during pregnancy that were of medical concern?
Yes
No
Did your baby experience any labour/delivery complications that were of medical concern?
Yes
No
Has your baby experienced any postnatal complications/illnesses that were of medical concern?
Please indicate ages of any other children:
WITHDRAW
CONTINUE


Infant Rearing Scale
18
Yes
No
Did your baby experience any complications during pregnancy that were of medical concern?
Yes
No
Did your baby experience any labour/delivery complications that were of medical concern?
Yes
No
Has your baby experienced any postnatal complications/illnesses that were of medical concern?
Please indicate ages of any other children:
WITHDRAW
CONTINUE


Infant Behaviour Study
Thank you for your participation. Our findings will be made available to view in due course on this website. Should you have any queries or concerns please contact fiona@infantbehaviourstudy.co.uk
If you would like to enter our prize-draw to win £30 in Boots vouchers please enter your email address in the box below. Many thanks.
WITHDRAW
FINISH

APPENDIX 5

5.1. Commercially available sling

5.2. Diary 2

Infant Behaviour Study

Daily Diary 2a

Age of baby on first day of diary 2:

…..…….weeks, …..……days

Participant Number……

Diary
Instructions

Diary 2 is similar to Diary 1 but with an additional page each day for you to record your use of the sling as an aid to settling (to sleep) and soothing (crying) your baby.

Please complete the daily records of your baby's feeding, sleeping and crying routines, from **midnight** of one day to **midnight** of the next, as accurately as possible. You are welcome to choose whether you complete it as you go along, or in one go at the end of each day. It will help us to collect more accurate data, however, if you complete only those parts which you can recall. Please do not feel obliged to fill spaces where you have forgotten; a '?' would be sufficient thank you. Feel free to use the back of the sheet or a separate continuation sheet if necessary but please remember to identify the episode (time/date).

The 'observations' sections are opportunities for you to describe anything unusual that might help us, and you, to uncover a pattern in your baby's routine. **However, should you have any concerns about your baby's routine; participation in this study must not prevent you from contacting your GP/health visitor as normal.**

Please refer to guidance notes and diary and sling–use examples in the Appendix to assist you in their completion.

Thank you once again for participating in this study.

If you have any queries regarding the diary or wish to withdraw from the study please contact:

Fiona Kaley: Tel: 0191 3340442 email: f.m.kaley@durham.ac.uk

Or

Anna Groendahl: Tel 0191 3343204

Guidance Notes for 'Observations' Sections

The following are suggestions on the type of information that you might wish to record in the 'observation' sections of the diary. The list is not exhaustive and is only a guide to the kinds of occurrences that might strike you as significant. Therefore they will not be necessary to enter every time.

Feeding:
Taking more of less time to breast feed / more or less formula milk.
Fussing, crying, discomfort during feed.
Reflux
More/less time to wind.

Day –time naps:
Longer/shorter than usual.
Fewer/more than usual.
Particularly easy / difficult to settle/wake.

Night-time sleep pattern:
Particularly easy/difficult to initially settle.
Particularly easy/difficult to settle after a disturbance.
When awake baby crying or wanting to play?

Crying:
Signs of physical discomfort such as:
Swollen tummy, legs drawn-up, back arched, flushed face, fists clenched, flatulence, intense crying, inconsolable etc.

If you have any queries regarding the diary or wish to withdraw from the study please contact:

Fiona Kaley: Tel: 0191 3340442 email: f.m.kaley@durham.ac.uk

Or

Anna Groendahl: Tel 0191 3343204

Feeds			
Event	Time of feed	Duration	Observations about baby's behaviour or changes to routine:
1			
2			
3			
4			
5			
6			
7			

Day-time Naps (between 7am and 7pm)				
Event	Time of Nap	Duration	How settled	Observations about baby's behaviour or changes to routine:
1				
2				
3				
4				
5				

Night-time sleep pattern (between 7pm and 7am)				
Time of initial sleep onset:				
Event	Time of wakening	Duration	How settled	Observations about baby's behaviour or changes to routine:
1				
2				
3				
4				

Crying					
Event	Time of onset	Duration	How consoled	Sudden onset? Y or N	Signs of physical discomfort
1					
2					
3					
4					
5					
6					
7					
8					

Any other comments such as: fever, constipation, vaccinations or changes to routine etc.

Sling use											
	Time	Purpose	Duration of sling use	If any, what methods to soothe your baby did you try other than sling use? *			How long did it take for baby to settle on this occasion?**				
use				Before sling	During sling	After sling	1	2	3	4	5
1											
2											
3											
4											

*** Other soothing methods for example:**
patting, rocking, massage, drink, ride in car, in pram, interaction, dark room, cot, medication/remedy etc.

****Time taken to settle:**
Please place a tick in the numbered box above that best describes how long it took for your baby to settle.

1 = Baby unhappy and removed from sling
2= Longer than 45 min to settle
3 = Baby settled within 45 minutes
4 = Baby settled within 30 minutes
5 = Baby settled within 15 minutes.

Any other comments:

Infant Behaviour Study

Daily Diary 2b

Age of baby on first day of diary 2:

…..…….weeks, …..……days

Participant Number……

Diary
Instructions

Diary 2 is similar to Diary 1 but with an additional page each day to record the methods you use to settle (to sleep) or soothe (crying) your baby. ***Please do not include routine feeding crying.***

Please complete the daily records of your baby's feeding, sleeping and crying routines, from **midnight** of one day to **midnight** of the next, as accurately as possible. You are welcome to choose whether you complete it as you go along, or in one go at the end of each day. It will help us to collect more accurate data, however, if you complete only those parts which you can recall. Please do not feel obliged to fill spaces where you have forgotten; a '?' would be sufficient thank you. Feel free to use the back of the sheet or a separate continuation sheet if necessary but please remember to identify the episode (time/date).

The 'observations' sections are opportunities for you to describe anything unusual that might help us, and you, to uncover a pattern in your baby's routine. **However, should you have any concerns about your baby's routine; participation in this study must not prevent you from contacting your GP/health visitor as normal.**

Please refer to guidance notes and diary and sling–use examples in the Appendix to assist you in their completion.

Thank you once again for participating in this study.

If you have any queries regarding the diary or wish to withdraw from the study please contact:

Fiona Kaley: Tel: 0191 3340442 email: f.m.kaley@durham.ac.uk

Or

Anna Groendahl: Tel 0191 3343204

Guidance Notes for 'Observations' Sections

The following are suggestions on the type of information that you might wish to record in the 'observation' sections of the diary. The list is not exhaustive and is only a guide to the kinds of occurrences that might strike you as significant. Therefore they will not be necessary to enter every time.

Feeding:
Taking more of less time to breast feed / more or less formula milk.
Fussing, crying, discomfort during feed.
Reflux
More/less time to wind.

Day –time naps:
Longer/shorter than usual.
Fewer/more than usual.
Particularly easy / difficult to settle/wake.

Night-time sleep pattern:
Particularly easy/difficult to initially settle.
Particularly easy/difficult to settle after a disturbance.
When awake baby crying or wanting to play?

Crying:
Signs of physical discomfort such as:
Swollen tummy, legs drawn-up, back arched, flushed face, fists clenched, flatulence, intense crying, inconsolable etc.

If you have any queries regarding the diary or wish to withdraw from the study please contact:

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Or

Anna Groendahl: Tel: 0191 3343204

Feeds			
Event	Time of feed	Duration	Observations about baby's behaviour or changes to routine:
1			
2			
3			
4			
5			
6			
7			

Day-time Naps (between 7am and 7pm)				
Event	Time of Nap	Duration	How settled	Observations about baby's behaviour or changes to routine:
1				
2				
3				
4				
5				

Night-time sleep pattern (between 7pm and 7am)				
Time of initial sleep onset:				
Event	Time of wakening	Duration	How settled	Observations about baby's behaviour or changes to routine:
1				
2				
3				
4				

Crying					
Event	Time of onset	Duration	How consoled	Sudden onset? Y or N	Signs of physical discomfort
1					
2					
3					
4					
5					
6					
7					
8					

Any other comments such as: fever, constipation, vaccinations or changes to routine etc.

Settling / Soothing Baby								
	Approx Time	Purpose: settle to sleep or soothe crying?	What method or methods did you try to settle/soothe your baby? *	How long did it take for baby to settle/soothe on this occasion?**				
Occasion				1	2	3	4	5
1								
2								
3								
4								
5								
6								

*** Settling/soothing methods for example:**
patting, rocking, massage, drink, ride in car, in pram, interaction, dark room, cot, medication/remedy etc.

****Time taken to settle/soothe:**
Please place a tick in the numbered box above that best describes how long it took for your baby to settle/soothe **(i.e. stop crying or fall asleep)**

1 = **Longer** than 1 hour
2 = **Longer** than 45 min
3 = W**ithin** 45 minutes
4 = W**ithin** 30 minutes
5 = W**ithin** 15 minutes.

Any other comments:

5.3. Instructions for settle-sling use

1. Put arms through harness shoulder straps like a jacket.
2. Click together front buckle
3. Pull-up seat section to waist position (ties through loops?).
4. Adjust and tighten to fit snugly around waist
5. Place baby in harness, resting their bottom on the seat and legs either side of your body.
6. Support baby's back and head with arm.
7. Secure baby's lower body by bringing up seat strap and clipping to the harness, pull tag to adjust (repeat 6 and 7 on other side). Adjustment of these straps will raises and lowers baby's stomach – increasing or decreasing back curvature
8. Pull-up remaining straps on either side to provide head support (and clip in place?). Adjustment of these straps at the clip will raise and lower baby's head and reduce stimulation.
9. Adjust (slide up/down?) back panel to support babies head at the correct height.